# OFFICIAL MAP PUBLICATIONS

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# OFFICIAL
# MAP PUBLICATIONS

# OFFICIAL MAP PUBLICATIONS

A historical sketch, and a bibliographical handbook of current maps and mapping services in the United States, Canada, Latin America, France, Great Britain, Germany, and certain other countries

By
WALTER THIELE
*Under the direction of*
A. F. KUHLMAN

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PUBLISHER'S NOTE

To make it possible to sell this book at a moderate price, production cost was reduced by omitting the customary typing of a master copy for planographing. Instead, the manuscript was photographed exactly as it came from the author. This statement is made to explain any imperfections, irregularities, or deviations from A.L.A. style.

# F O R E W O R D

In 1934 the Joint Committee on Materials for Research of the American Council of Learned Societies and the Social Science Research Council requested the writer to prepare a Guide for the Collection, Care, Organization and Preservation of Fugitive Materials in the social sciences and humanities. The term fugitive materials was employed in its generic sense as including those research materials that tend to escape collection, proper care, organization and preservation in libraries.

The original plan for the Guide called for a manual with separate chapters dealing with the principal types of fugitive materials such as maps, manuscripts, pamphlets. However, as the work progressed it seemed that a separate monograph was necessary to treat certain of these types adequately with a summary chapter for each type of material in the Guide. Thus this Bibliographical Handbook dealing with official map publications gradually evolved into a large monograph, which in such large measure fell outside of the original project that it could not properly be included in it. It is therefore offered as a separate publication and, except as a by-product, has no other connection with the Joint Committee's project.

This volume concerns itself with the fascinating evolution of the modern map; with the variety of form and multiplicity of purpose for which it is issued; with the official agencies from which different kinds of maps can be obtained and finally with schemes for organization and preservation of maps.

Few libraries have in the past given the collection, care, organization and preservation of contemporary maps the attention that they deserve. Old historical maps have always been recognized by librarians as of importance, but during the past two decades the uses of the modern or contemporary map have been completely transformed. At least four factors explain this new and larger use of the current map: (1) The development of our highway system and extensive motoring by the people representing all classes has made this age map conscious. The result has been

that many public libraries have found it desirable to develop a travelers' information bureau in which all kinds of current maps are used. (2) Public planning as is shown in Appendix IV has become almost universal, and in it maps play a large role. Through public planning bodies the people are becoming familiar with many of the governmental mapping services and even librarians are getting a new appreciation of the large role played by maps in the service of the government. (3) In research in the social sciences maps and charts are used increasingly in portraying distribution phenomena. (4) Visual methods depending upon the use of maps are being employed in education on a large scale.

The Publishing Department of the American Library Association has been aware of the larger service that maps can and must play in our libraries and credit is due to it for urging upon Mr. Thiele and the undersigned the completion of this monograph and for its willingness to publish it. Obviously in this volume Mr. Thiele has provided a guide which should be immensely helpful to libraries and to planning agencies that want to do something about maps.

A. F. Kuhlman

TABLE OF CONTENTS


Page

PREFACE . . . . . ix

PART I

A HISTORICAL SKETCH

Chapter

I. MAPS AND MAPPING AMONG THE ANCIENTS . . . . . 3

II. CARTOGRAPHY DURING THE MIDDLE AGES. . . . . 10

III. THE BEGINNINGS OF MODERN CARTOGRAPHY. . . . . 22

IV. TRANSITIONAL CARTOGRAPHY IN THE SIXTEENTH AND SEVENTEENTH CENTURIES. . . . . 27

V. THE EVOLUTION OF SCIENTIFIC CARTOGRAPHY IN FRANCE FROM THE SEVENTEENTH TO THE NINETEENTH CENTURY. . . . 34

VI. MODERN BRITISH CARTOGRAPHY BEFORE THE ESTABLISHMENT OF THE ORDNANCE SURVEY. . . . . 51

VII. THE MAPPING OF THE NORTH AMERICAN CONTINENT IN THE SIXTEENTH CENTURY . . . . . 59

VIII. THE CARTOGRAPHY OF NORTH AMERICA IN THE SEVENTEENTH, EIGHTEENTH, AND EARLY NINETEENTH CENTURIES. . . . . 84

IX. EXPLORATION AND MAPPING IN THE UNITED STATES IN THE NINETEENTH CENTURY. . . . . 107

PART II

CONTEMPORARY GOVERNMENT MAPS AND MAPPING SERVICES

X. THE MAPPING SERVICES OF THE UNITED STATES GOVERNMENT. 119

XI. REFERENCE LIST OF MAP PUBLICATIONS ISSUED BY THE UNITED STATES GOVERNMENT. . . . . 175

XII. OFFICIAL MAP PUBLICATIONS OF CANADA . . . . . 221

XIII. PRESENT STATUS OF TOPOGRAPHIC MAPPING IN LATIN AMERICA . . . . . 232

XIV. OFFICIAL MAP PUBLICATIONS OF GREAT BRITAIN. . . . . 242

Chapter Page

XV. OFFICIAL MAP PUBLICATIONS OF GERMANY. . . . . 258

XVI. SUMMARIES OF THE OFFICIAL MAP PUBLICATIONS OF (1) AUSTRIA, (2) HUNGARY, (3) NETHERLANDS, AND (4) NORWAY. . . . . 274

XVII. CLASSIFICATION, CATALOGING, AND CARE OF MAPS. . . . . 282

APPENDIX

I. TENTATIVE MAP CLASSIFICATION OUTLINE, BY SUBJECT. . . 297

II. MAP CLASSIFICATION OUTLINE BY AREA. . . . . 309

III. STATE GOVERNMENTS OF THE UNITED STATES AS MAP SOURCES . . . . . 312

List of Geologic Maps of States . . . . . 315
List of State Maps Issued by the Federal Government. . . . . 325

IV. PUBLIC PLANNING ORGANIZATIONS IN THE UNITED STATES AND THEIR MAP PUBLICATIONS. . . . . 327

Local Planning Organizations. . . . . 327
State Planning Boards . . . . . 328
Regional Planning Organizations . . . . . 330
National Resources Committee. . . . . 335

V. LIST OF INTERNATIONAL MAPS. . . . . 339

INDEX . . . . . 343

# P R E F A C E

The primary purpose of this handbook is to serve as a guide to the map publications which are currently made available by national government mapping services. The place of the government in the mapping of the nation has long been a dominant one. The strategic value of maps in military campaigns and their unique usefulness in the delineation of political boundaries early made the preparation of maps one of the vital functions of government. The scope of government mapping has, moreover, considerably broadened in the course of time. Today, the production of maps for military and political purposes is no longer the sole aim of governments, as is convincingly evidenced by the wealth of highly diversified map material which is annually made available by them.[1] As one example of this development may be cited the recent output, throughout the United States, of large numbers of planning maps which portray nearly every vital phase of the distribution and utilization of the national resources, both physical and human.[2] But in spite of the fundamental and increasingly more varied role played by government maps in the economic and social life of the nation, little precise knowledge is current regarding them, even among the map-minded public. The reason for this condition is no doubt largely to be found in the lack of a serviceable bibliographical guide. An attempt to be such a guide has been made in this handbook. A brief outline of its scope and arrangement is given in the following paragraphs.

The book is divided into two main parts and an appendix. Part I consists of an introductory historical sketch. Part II contains the core of the book; that is, the chapters on current government maps and mapping services, and an additional chapter

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[1] An examination of the outline of map titles which is given in Appendix I may help to realize the broad significance of this statement. Many of the titles listed have been copied from government maps.

[2] A description of the public planning organizations in the United States is to be found in Appendix IV.

on the care of maps. The more significant items relegated to the appendix are a summary account of the public planning organizations in the United States, and a brief recital of the maps and mapping services of state and local governments. The index at the end of the volume is particularly comprehensive with respect to current map publications.

The presence of the introductory historical sketch, which takes up all of Part I, may need a word of explanation. Its purpose is the twofold one of providing a historical background to the treatment of contemporary maps in Part II, and of serving as a bibliographical repository of the widely scattered literature on the evolution of mapping through the ages. That the sketch gradually assumed, in the course of its preparation, the proportions it now has, is largely explained by the vastness and inherent complexity of the subject matter. It should be emphasized, however, that even this "lengthy" sketch is little more than the barest outline, with plenty of lacunae and other shortcomings, of the very fascinating but exceedingly involved history behind the modern map.

Part II and Appendices III and IV are entirely given to the description or listing of the current map publications and mapping services of the governments of the United States, of Canada, and of a select number of other nations. Needless to say, the map publications of the United States and Canada have been treated with special thoroughness, for here it was possible to have recourse to personal correspondence with the officials in charge of the individual mapping services. With regard to the map publications of the remaining countries it was necessary to rely solely upon published sources. It is sincerely hoped, however, that the mapping authorities of these countries will kindly make available whatever additions or corrections they deem desirable so that proper amends can be made in case a revised edition of the handbook should become necessary.

The chapter on the classification and care of maps (Chapter XVII) is mainly an exposition, by means of illustrative examples, of some of the more typical problems encountered in the classification and cataloging of map collections. It is now possible to announce that a thorough treatment of these intricate subjects will before long be available through the publication, by Mr. S. W. Boggs and Mrs. D. C. Lewis, of a considerably

revised edition of their manual on the classification and cataloging of maps and atlases, the first edition of which was issued in mimeographed form.

The tentative subject outline of map titles, which is presented as Appendix I, is chiefly the result of a searching examination of a large number of maps and map titles, particularly of special-purpose maps. The reason for the inclusion of this outline is solely its possible suggestive value with respect to the kinds of maps and map data that may be found under certain subject headings. For an exposition of a practical and systematic subject classification for maps, the reader is again referred to the prospective publication of the Boggs and Lewis manual.

The chapters devoted to the maps and mapping services of the United States government (Chapters X and XI) need more extensive comment. The first of these chapters lists and classifies the various government mapping services and briefly describes their mapping functions. The second chapter gives a systematic listing of the maps, map lists, and index charts which are made available by each government service. The order of presentation of this material is alphabetical with regard to the names of the map-issuing bureaus and departments.

A feature of the chapter (Chapter XI) on United States government map publications is its fairly complete listing of the United States Army Corps of Engineers' divisions and districts, and of their river and harbor charts.[3] It may here be added that such charts are also included in the preliminary reports on river and harbor projects of the Chief of Engineers, United States Army, and can be traced through the biennial Catalogue of Public Documents . . . ., more familiarly known as Document Catalogue. The river charts which formerly supplemented the annual report of the Chief of Engineers may be found listed in the Index to the Reports of the Chief of Engineers, U.S. Army, Vol. I (1866-12), and Vol. II (1913-17), the chart references being given at the end of the survey report entries. No later index volume has been issued. The United States Geological Survey also publishes river charts. These are the result of studies made in connection with

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[3]These charts are primarily intended for the navigator. They are usually on the scale of 1:10,000 and 1:20,000 and depict such features as depth of water, rapids, location and character of obstructions, and topography of the river banks.

water storage for flood protection, water supply and power development.[4] The charts are usually published as supplements to the Survey's reports and papers on water supply and power. A list of the charts as issued up to 1926 is contained in the Survey's Water-Supply Paper 558 (1926). For listings of the more recent charts reference may be made to the index-circulars,[5] and the monthly announcements of new publications which are issued free by the Survey.

No formal mention has been made of a number of highly accurate special maps which have been prepared by the engineering departments of city governments in the United States, because these maps are not available for distribution. There are, however, two important sources of local maps, although not governmental, that may be briefly noted. They are the widely available base maps or plats which subdividers are required to file in most cities, and the fire insurance maps published by the Sanborn Map Company of Chicago and New York. The former are ordinarily prepared by private surveyors under provisions of state or local ordinances. The maps are not very uniform as to scale and other details of drafting and must first be rectified before they can be used for making a city plan. The Sanborn maps are described below.[6]

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[4]These charts are chiefly of value to the engineer. They are usually on the standard scale of 1:31,680 and show detailed topography of the land adjacent to the river bed to a height of 200 feet, or more, above water surface, with indication of contour lines representing 20, 25, or 50-foot intervals. Elevation of water surface is shown by 5-foot contour lines.

[5]See page 325 for a description of these index-circulars.

[6]Fire insurance maps.--These maps are not of government origin but are mentioned here because of their great importance in many towns and cities of the United States. It is understood that the Sanborn Company is the sole provider of these maps. They cover at present approximately fourteen thousand cities and towns in the United States, Alaska, and Hawaii. The maps are in the form of diagrammatic plans or charts, and are mainly intended for the professional use of the fire insurance fraternity; they are also widely used by mortgage underwriters, public works and tax officials. The more specific purpose of the maps is to show the location and construction of buildings so as to permit a correct appraisal of fire hazard and insurance risk. The scale of the maps is 1 inch to 50 feet for heavily developed urban areas and one half this scale for outlying residential districts. The size of the map sheets is uniformly 22½ x 25 inches; they are available in bound and unbound form. The price of the unbound

Aerial photographs and aerial maps have not been dealt with in this volume. The principal reason for this omission is that an aerial photograph or map is not a map in the conventional sense of this term. And a true map which has been derived from aerial photographs by means of photogrammetric processes does no longer resemble a photograph but is in every sense a conventional map. A photograph, it may be recalled, is a perspective or conic projection; a map is an orthographic projection which is true to scale all over and appears as viewed directly from overhead. The photogrammetric processes which are applied to aerial photographs for the purpose of making true maps from them, aim precisely at the translation of the perspective photographic image into an orthographic projection image which is uniformly true to scale. The result of the application to the photographs of these rectification processes is the so-called plane or planimetric map, which is a true map in that it is accurate in area, scale, position, distance and direction, but it does not show elevation and slope and is without contour lines. Such lines can be added, however, with the help of stereo-plotting machines, such as the multiplex, and the aerocartograph. These machines make use of the familiar stereoscopic effect produced by overlapping photographs. The configurations of the ground are thus made plainly visible to the map maker so that he is able to draw in the contour lines. The result is a highly accurate topographic map with contour lines, and which has the added advantage of being very much cheaper to produce than the ordinary topographic map of equal quality made by plane-table methods.

A more direct and much more general use is made of aerial photographs that have been combined to form a mosaic map. This is an assembly of two or more overlapping vertical photographs which are so cut and fitted together as to form one composite picture of the area.[7] The map can be prepared very quickly and

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map sheets ranges from $10 to about $79; the atlas sheets are less costly, for they are priced as low as $1 a sheet. Annual revision is made only of the maps covering the larger cities. Sets of the maps are not usually kept on file in public libraries. They may be found, however, in municipal reference libraries and also in the offices of the larger fire insurance companies and real estate brokers.

[7]A map assembled in this manner retains all the errors inherent in photographs which have not been rectified to a true

cheaply and is used very extensively in connection with land-use problems and all kinds of planning and reconnaissance work. In the United States, the Agricultural Adjustment Administration and the Soil Conservation Service, both of the Department of Agriculture, are especially heavy users of the controlled mosaic map. It is believed that the Department has presently aerial maps available of more than half a million square miles out of the total approximately 1,650,000 square miles of farm land area in the United States. Other Federal government services importantly concerned with aerial photographs are the Corps of Engineers, U.S. Army, the Geological Survey, the Coast and Geodetic Survey, the Army Air Corps, the Forest Service, and the Tennessee Valley Authority. Information about areas for which aerial photographs or maps have been made may perhaps be obtainable from the Federal Board of Surveys and Maps, Washington, D.C. A map, showing the status of aerial mapping in the United States, is listed on page 220, following. No central recording office has as yet been established in the United States for the listing and indexing of all available aerial photographs and maps, although it is believed that the creation of such an office is having attention.

The task of preparing this handbook was commenced in 1935, except Appendices III, IV, and V, which were added subsequently. Publication was delayed somewhat by force of circumstances attending change of sponsors, as has been explained in the Foreword. However, the delay afforded a welcome opportunity to check the contents of the manuscript against the latest available map information and literature, and this was done

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horizontal scale or plane. The only part of the map which can even be considered as on a true scale is the area vertically below the center of the camera lens. A more accurate or "controlled" mosaic map is obtained by first enlarging or reducing the individual photographs so as to make them of fairly uniform scale, and then to fit them to predetermined positions which have been independently plotted on a base sheet. These positions usually contain topographic features which are identifiable on the photographs, and have been geographically located on the ground by regular surveying methods. This map is fairly reliable.

It is not absolutely impossible to make an accurate mosaic map by means of aerial photographs. But this would require that the aerial photographs be taken so close together that only the very central portion of each photograph would need to be utilized for making the map. If all these central portions were first rectified to one horizontal scale, a mosaic map would be obtained which would closely approach a true map. But the cost would be prohibitive.

especially with regard to the map publications of the United States government. But in spite of the resulting partial revision of the manuscript, this first edition of the handbook is considered essentially of a preliminary nature and is as such submitted to the field for frank criticism and suggestions for improvement. Kind request is made that all such observations be forwarded to Dr. A. F. Kuhlman, in care of Vanderbilt University, Nashville, Tennessee.

The list of contributors to the handbook is a long one. Particularly is this true of the chapters devoted to the map publications of the United States and Canada, for they are mainly based on the authentic map information supplied by nearly three score of government officials. To list the names of all these contributors is unfortunately impossible. It must suffice, therefore, to express a debt of gratitude to them collectively, and to confine personal mention to a few of the more outstanding contributors among them.

In Canada, it is to the Surveyor-General of the Topographic and Air Survey Bureau, Mr. F. H. Peters, that thanks are due for active interest in the preparation of the chapter dealing with Canadian map publications, and for proofreading said chapter.

In the United States, gratitude is expressed to Dr. W. C. Mendenhall, Director of the United States Geological Survey, for proofreading the section in Chapter XI, which lists the map publications of the Survey, and for permission to make use of a list of geologic maps of states, which was compiled by the Survey; to Chief Inspector K. P. Aldrich, United States Post Office Department, for a detailed list of historical and contemporary post road maps; to Secretary Edgar A. Klapp, United States Section, International Boundary Commission, United States, Alaska, and Canada, and to Commissioner Lawrence M. Lawson, American Section, International Boundary Commission, United States and Mexico, for selective lists of their respective boundary maps; to the Office of the Historical Advisor, Department of State, for an up-to-date list of the maps issued by the Department; to the Mississippi River Commission and the Ohio River Division, both of the Corps of Engineers, United States Army, for detailed lists of their numerous map and chart publications; and to Mr. S. W. Boggs, Geographer, Department of State, Mr. Archibald B. Williams, of the Geographic Branch, General Staff, and Miss Clara Egli, of the

Map Division, Library of Congress, for critical perusal of the chapter on map classification. A number of direct acknowledgments have also been inserted in footnotes.

For aid received locally, especially in the technical preparation of the manuscript, thanks are due tc Helmuth Bay, Assistant Manager, Department of Cartography, the Rand McNally Company, Chicago, whose expert advice and criticism were solicited from time to time; and to Miss Mary McEldowney of the University of Chicago Press, who proofread part of the manuscript and assisted in the compilation of the index.

The debt owed to the University of Chicago Libraries and their Director, Dr. M. Llewellyn Raney, is quite beyond appraisal; suffice it to say that the entire manuscript was prepared on the library premises of the university. Without the generous hospitality of the library and the courteous cooperation of the staff this handbook could not have been prepared.

To Dr. A. F. Kuhlman, the former Associate Director of the University Libraries and present Director of the Joint University Libraries, Nashville, Tennessee, the writer owes a very heavy personal debt. For Dr. Kuhlman not only conceived of this project but also gave considerable assistance towards its execution. It may be recalled that communications regarding the contents of the handbook are kindly to be forwarded to Dr. Kuhlman, in care of Vanderbilt University, Nashville, Tennessee.

Finally, gratitude is tendered to the American Library Association, to its Editorial Committee, its Chief of the Publishing Department, Everett O. Fontaine, and its Editor of Publications, Harold English, for their cordial and enthusiastic sponsorship of this handbook, and their great patience in seeing it through.

W. T.

January, 1938.

# PART I

## A HISTORICAL SKETCH

## CHAPTER I

## MAPS AND MAPPING AMONG THE ANCIENTS

### Definition of Terms

The object of geographical maps and charts is to exhibit on a plane surface, with due regard to true position, distance, and direction, a portion or all of the natural and cultural features of the earth's surface. The purpose for which a map is made primarily determines not only its size, scale, and projection, but also the nature and the fullness of the material to be exhibited. Broadly speaking, maps may be divided into two classes, of which the first includes general and topographical maps, and the second, the great variety of maps designed for an ever increasing number of special purposes. This sketch is primarily concerned with the first class.

The term "map" is derived from the Latin word mappa, meaning a sheet of cloth, about the size of a handkerchief. The early Romans did not, however, use the word mappa, or mappa-mundi to designate their geographical maps. They used instead such terms as: Forma; tabula chorographia; orbis pictus; sphaera and, occasionally, pictura.[1] So late as the middle of the eighth century we note a world map issued at Rome, entitled Orbis terrarum descriptio and in 776 we see Beatus calling his world map Formula pictuarum. The first application of the term mappa-mundi to medieval world maps was made in the ninth century by the monk Micon of St. Riquier who flourished about 840.

Nor was the term "atlas" the earliest word used in connection with a collection of maps. When Ortelius of Antwerp published the first collection of modern maps in 1570, he chose for his great work the title of Theatrum orbis terrarum. His example was followed in England by John Speed who named his atlas Theater of The Empire of Great Britain, and in France by M. Bouguereau who called

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[1]Richard Uhden, "Zur Herkunft und Systematik der mittelalterlichen Weltkarten," Geographische Zeitschrift, XXVII (1931), 32.

his collection of maps Theatre François (1594). Still other terms in use were: Speculum orbis terrarum; Speculum Britanniae; Geographia; and Cosmographia. But none of these expressions found general acceptance, and they all gave way to the term "atlas" which was introduced by Gerhard Mercator (1512-94), and first applied by him to his collection of 107 maps entitled, Atlas sive cosmographicae meditaciones de fabrica mundi et fabricati figura,[2] published posthumously at Duisburg, Germany, in 1595.

## Beginnings of Scientific Cartography Among the Ancient Greeks[3]

We know from various references in the works of the ancients that maps were in use from very early times; but of these maps, which were probably only of a local type, we have little definite knowledge. The earliest remaining example is a small circular map of late Babylonian origin which represents, in an elementary manner, the Mesopotamian district. Although dating from about 500 B.C., it is thought to be based upon geographical ideas of a still earlier period. Of the early Egyptians, so justly famous as "geometers," there are recorded numerous examples of cartographic representation, and some of their maps and plans have actually been discovered on ancient papyrus rolls.

That, in the course of time, a wealth of geographical documents accumulated in the famous library at Alexandria is dwelt upon at length by Strabo in his great treatise on geography. We also learn from Strabo that the renowned astronomer and geographer, Eratosthenes of Cyrene (circa 276-194 B.C.), the chief librarian at Alexandria, based his measurements of the length of a degree of arc on these documents and maps of the ancients. Eratosthenes also recognized the sphericity of the earth and was the first person to make rational geodetic measurements of its circumference, which he estimated at twenty-five thousand geographical miles instead of statute miles. However, the chief object in his study

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[3]This section is chiefly based on Edward Herbert Bunbury's History of Ancient Geography among the Greeks and Romans, from the Earliest Ages till the Fall of the Roman Empire (2 vols.; London, 1879). Though old, this is the best work on the subject in English. In German the best work is, Hugo Berger, Geschichte der wissenschaftlichen Erdkunde der Griechen (2te Auflage; Leipzig, 1903); see also H. F. Tozer, History of Ancient Geography (2d ed.; Cambridge: The University Press, 1935). See also W. A. Heidel, The Frame of the Ancient Greek Maps . . . (New York: American Geographical Society [Research Series No. 20], 1937).

of geography was the "reform" of the map of the world. Indeed Eratosthenes' three-volume treatise which dealt systematically with the geographical knowledge of his time was primarily written to illustrate and explain his map of the world. This map, notwithstanding its many errors, such as the connection of the Caspian with a northern ocean and the supposition that Carthage, Sicily, and Rome lay on the same meridian, enjoyed a high reputation in its time. Even Strabo adopted its main features.

The next most important name in ancient Greek cartography is that of the astronomer Hipparchus (flourished circa 140 B.C.) who worked at Nicaea, his birthplace, and in Rhodes and Alexandria. It is not known whether Hipparchus compiled any maps himself but his value as a critic and as a propounder of more scientific methods of map construction is admittedly high. He criticized Eratosthenes' map because he considered its contents too largely based on hypotheses and he proposed that in map construction recourse be had to latitudes and longitudes deduced from astronomical observations.[4] He also demanded that maps be based upon a regular projection, several descriptions of which he included with his star maps. He likewise divided the great circle into $360^{\circ}$, and introduced a system of climata or zones of latitude, based upon the length of the longest day on successive parallels and upon observations of various constellations. The fact that his prime meridian ran through Alexandria, Rhodes and Byzantium illustrates his limitations, and his inferences concerning the outer margins of the known world, such as the extent of Asia, were even more erroneous than those of Eratosthenes. The principle of the spherical astrolabe is said to have been known to Eratosthenes, but the instrument was greatly improved by Hipparchus. It was used not only for observing astronomical altitudes, but also for topographical purposes as late as the seventeenth century.

The period from Hipparchus to Marinus of Tyre (70-130 A.D.), though of great historical import in more than one respect, made no contribution to cartographic progress. To Marinus belongs the credit for having returned to the scientific principles of Eratosthenes and Hipparchus, and of having added to them. None of the works of Marinus have survived, and we know of him only through Ptolemy's writings. But the latter is unstinting in his

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[4]Bunbury, op. cit., II, 3.

acknowledgment of the debt which he owes Marinus, and professes to come forward himself rather as the corrector of points in which the work of Marinus was deficient than as the originator of an independent scheme.

Marinus' great ambition, like that of Eratosthenes, seems to have been to "reform" the map of the world.[5] But there was this difference; while with Eratosthenes scientific questions of general import, such as the measurement of the circumference of the earth, held first place, Marinus was above all concerned with rendering maps more accurate in detail. As far as we know, he was the first person to lay down the position of places on a projection of latitudes and longitudes determined as far as possible by means of astronomical observations according to the directions of Hipparchus. It is true that the resulting map left much to be desired, for the parallels of latitude and the meridians of longitude were represented by straight lines intersecting each other at right angles--a system the faultiness of which Marinus must have recognized for he had passed criticism on the attempt of his predecessors to delineate the spherical surface of the globe on a plane map.

Of Claudius Ptolemaeus, or Ptolemy (90-168 A.D.), one of the most famous of all ancient geographers, hardly any biographical details have come down to us. It is probable that he was born at Hermeiu and that he studied and wrote at Alexandria, where the renowned school of letters which had been founded by the Greek rulers of Egypt still flourished. His treatise on geography[6] was published subsequent to his completion of his astronomical work, and its date may be fixed somewhere between 140 and 150 A.D.

The term "geography" in the sense used by Ptolemy, signifies the delineation of the known world in the shape of a map.[7] In fact, his work is fundamentally a course of instruction in the making of maps, and a collection of data for doing so. But the method to which Ptolemy had recourse was entirely different from

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[5]Bunbury, op. cit., p. 520.

[6]See the Edward Luther Stevenson translation of the Geography of Claudius Ptolemy . . . . (New York: New York Public Library, 1932).

[7]Bunbury, op. cit., p. 549.

both Eratosthenes and Marinus. Ptolemy fully realized that a map could be laid down correctly only on the basis of astronomically determined latitudes and longitudes. Unfortunately, the number of such observations at his command was so small that it was impossible for him to construct a map wholly on such a basis. He therefore was obliged to determine the leading positions on his map largely by the old and crude methods of his predecessors, that is, by calculating and comparing itineraries, rendering days' journeys into stadia, and other similar means. But if Ptolemy's place data had for the most part been ascertained in this crude manner, they were laid down on the map as though they were really observed longitudes and latitudes, thus giving a strictly scientific form to what had no such basis in fact. Indeed, he drew up copious tables giving, in degrees and parts of a degree, latitude and longitude of every place on his map. Six out of the eight books which compose his geography consist almost entirely of such tables. The very convenience and regularity of this form made it relatively easy for any careful student to construct the maps from these data alone, and this was done throughout the ages. Ptolemy's work had thus assumed the form which Hipparchus had looked forward to as the ultimate desideratum in geography. How far it fell short of this ideal in reality only a careful examination would reveal.

The whole design and character of Ptolemy's work is so intimately connected with map construction that a series of maps most likely accompanied the original edition. Whether the maps which supplement existing copies of his work represent the originals it is difficult to judge.

We may note briefly that with respect to the mathematical construction or projection of his maps, Ptolemy was far in advance of his predecessors; that he held to the theory of the fixed earth, admitting neither its rotation nor its revolution; that he accepted the Posidonius' figure of eighteen thousand geographical miles as representing the circumference of the earth; that he placed the equator too far north since its position was reckoned from the northern tropic taken to pass through Assuan; and that he followed Marinus in choosing an arbitrary prime meridian passing through the Fortunate Isles, and these he supposed to be about $7^{\circ}$ more easterly than the real position.

In the main, Ptolemy seems to have copied Marinus' work, though not without important revisions and additions and the

introduction of some new and serious errors. Nevertheless, the scientific method applied by him was sound, and although he remained unknown and neglected throughout the Middle Ages, his rediscovery during the Renaissance justly brought him acknowledgment as one of the founders of cartography as a modern science.

## Cartography Among the Ancient Romans

That the ancient Romans had both general and topographical maps may be learned from the writings of Cicero, Seneca, Suetonius, Pliny, and others. It is true that these writers represent a relatively late period. Indeed it has been said that the Republic conquered the world without maps, but that the Empire governed it by using them.[8] The results of an extensive survey of the provinces carried out by Agrippa in the reign of Augustus was displayed in the public porticos of Rome in the form of a large map. Like so many other Roman works, maps were produced by the state for public rather than for private use; indeed Suetonius has recorded that under Domitian it was a grave offence for a private person to have a map of the world in his possession.[9] In fine, the Roman interest in map-making seems to have been a purely practical one and no contribution to scientific cartography was made by them.

Only two of their cartographic specimens have come down to us. One of them, representing parts of a plan of Rome and dating from the time of the Emperor Septimius Severus (193-211 A.D.), is now preserved in tne Museo Capitalino, while the other, an Itinerarium Scriptum, or road map of the world, is the famous Tabula Peutingeriana,[10] now in the possession of the library at Vienna. This latter map, which dates apparently from the third century, was copied by a monk in Colmar, in 1265, and acquired by the learned Conrad Peutinger, of Augsburg, whose name it bears. The map is a curious, distorted, and diagrammatic

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[8]Martin Percival Charlesworth, Trade Routes and Commerce of the Roman Empire (Cambridge: The University Press, 1924), p. 13.

[9]Michael C. Andrews, "The Study and Classification of Medieval Mappae Mundi," Archaeologia, LXXV (1924-25), 62.

[10]See Konrad Miller, Itineraria Romana, Römische Reisewege an der Hand der Tabula Peutingeriana (Stuttgart, 1916); see also, Gerard Gaston Dept., "Notes sur la Tabula Peutingeriana," Revue Belge de Philologie et d'Histoire, X (1931), 998-1011, which is a critical review of the recent literature on the map.

representation of surface, in the nature of a road map. It is made up of twelve strips which may be laid end on end to form a single map. From the point of view of cartography, the map is of little interest.

## CHAPTER II

## CARTOGRAPHY DURING THE MIDDLE AGES

A long and relatively barren chapter in the history of cartography is represented by the period lasting from the third or fourth century of the Christian era till the fourteenth or fifteenth--the so-called Middle Ages. Although it did not in any way tend to progress or development, and, being closed, has left no mark upon the modern map, it is believed profitable to give a brief outline of the position and development of the medieval mappae mundi.

Indeed, stagnation and regression mark the centuries that followed Ptolemy and Marinus of Tyre, as far as scientific matters are concerned. Most of the old errors respecting the confines of the habitable world now reappear, and the peopled globe is once more confined to the northern hemisphere. The southward extension of Africa is ignored, and the Nile is supposed to cross that country from west to east in a line parallel to the Southern Ocean. Egypt is regarded as part of western Asia, and Africa commences on the western side of that country. These and numerous other errors were perpetuated by subsequent writers and, with the addition of other fictitious features derived from ecclesiastical sources, became imbedded in medieval cartography.

### Medieval Mappae Mundi[1]

The maps resulting from these conceptions were chiefly of three types: viz., an oblong rectangular, a circular, and an oval type--the latter being either a compromise between the two former

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[1]Charles Raymond Beazley's Dawn of Modern Geography (3 vols.; London, 1897-1906), is the standard work in English for the period from 300 to 1420; though the emphasis is on discovery and exploration, cartography is also treated and many reproductions of maps are given. The standard work on medieval cartography is Konrad Miller's Mappaemundi, die aeltesten Weltkarten (6 vols.; Stuttgart, 1895-98); see also John Kirkland Wright, The Geographic Lore of the Time of the Crusades . . . . (New York: American Geographical Society, 1925); this is a scholarly study in the history of medieval science and tradition in Western Europe. Medieval maps receive some consideration. An extensive bibliography is appended for further study.

or an artistic development of the circular type.[2] In every instance the inhabited world is surrounded by the ocean. There are no longitudes or latitudes; no use was made of astronomical observations, for the authors of the maps looked upon the Tabernacle as the image of the world at large. In nearly every case the East occupies the top of the map. Paradise is placed in the Far East. There is no scale.

The oldest rectangular map of the world is contained in a valuable work written by the Alexandrian monk, Cosmas, surnamed Indicopleustes. The work is entitled Christian Topography,[3] and was apparently written during the years from 535 to 547, although the earliest manuscript we possess of this work goes back only to the ninth century. Cosmas believed that the figure of the universe resembled the Tabernacle which Moses prepared in the wilderness, and the division of this Tabernacle into two compartments, by means of the veil, typified to him the division of the universe into two worlds--an upper and a lower, by means of the firmament. The table of shew-bread with its waved border, represented the earth surrounded by the ocean, while its other parts and the things upon it symbolized each some object or other in the natural world. Cosmas' mappa mundi shows an earth that is flat, rectangular, and oblong, twice as long west and east as north and south, and surrounded by oceans. The arguments which he employs to establish his theories concerning the form and content of the universe are absurd in the extreme; and were it not for the geographical, historical, and other kinds of notices which are here and there incidentally introduced into its pages, his work would chiefly serve for amusement.

The form of Cosmas' mappa mundi is closely repeated in the earliest world map that has actually come down to us from the Middle Ages, namely the map preserved in the library of Albi at Languedoc.[4] It occurs in a manuscript of the eighth century and

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[2]See Richard Uhden, op. cit.; also Michael C. Andrews, op. cit.

[3]The work has been ably translated and edited for the Hakluyt Society. See J. W. McCrindle, The Christian Topography of Cosmas, an Egyptian Monk (["Hakluyt Society," 1st ser., Vol. XCVIII] London, 1897). Pp. xxvii, 398; maps.

[4]Beazley, op. cit., I, 385.

is designed to illustrate the cosmography of Julius Honorius and of Orosius; but it is a mere sketch, very poorly executed, and with many bad mistakes. Yet poor as it is, the Albi map is the unaltered work of the time of Bede and of Charles Martel (circa 730 A.D.) and is accordingly venerable as the oldest geographical monument of Latin or Western Europe in the Middle Ages.

A more ambitious attempt at map-drawing, and one that shows a considerable advance on the Albi mappe monde is represented by the world map of St. Sever, dating from the ninth or tenth century, and now preserved in the British Museum.[5] Here the form of the world map is shown as oblong but retaining the rounded corners of the earlier example. The names of countries are few, but the map abounds in pictorial detail of political and ecclesiastical significance, with the Terrestrial Paradise, and with Adam and Eve, occupying the center of the eastern portion of the picture.

This map, and several others that resemble it, are believed to be derived from a lost prototype ascribed to the Spanish monk Beatus who lived in the eighth century. The oldest surviving derivative dates from the tenth century (circa 970) and is known as the Ashburnham map; the most famous copy is the twelfth century Turin map.[6] In all the ten surviving examples of the Beatus map, save one, the East is at the top; Paradise is placed in the extreme East, on the mainland, encircled by unscaleable mountains, and accompanied by pictures, either of Adam and Eve, or of the Four Sacred Rivers.[7] The division of the continents is usually the same as that of the so-called "T-O" maps--Asia occupying the upper half, while in the lower part Europe has the left-hand quarter, Africa the right hand. The purpose of the map was probably to show the spread of the Christian faith over the world.

One of the most interesting of all medieval world pictures is the "Cotton" or Anglo-Saxon map of the tenth century--also preserved in the British Museum.[8] It is of small size and almost square in shape. It does not appear to belong to any of

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[5] Ibid., II, 549-59.

[6] Beazley, op. cit., I, 387.

[7] Ibid., II, 554-55.

[8] Ibid., pp. 559-63.

the ascertainable families of medieval maps. Professor Beazley says of it that "there is hardly any map of the Middle Ages before the appearance of the portolans which can be compared, in the general contour of the great landmasses with the 'Cottonia.'"[9] The content of the map represents a mixture of biblical and classical geography, for in addition to Jerusalem and Bethlehem and the countries of the tribes of Dan and Zebulon, the classical Pillars of Hercules are actually depicted outside the entrance to the Mediterranean. One of the main objectives of the map was to present a picture of the settlement of the Twelve Tribes of Israel.

The Jerome maps--so called because they were probably drawn under the direction, if not by the hand of that Father, about the middle of the twelfth century--were apparently intended to illustrate three of his lesser treatises.[10] One of the maps represents Palestine and Lower Egypt only; the other deals with the Levant in a wider sense, reaching out to the Far East. Both are perhaps fragments of a lost mappe monde. The shape of each is almost exactly square, with the larger map measuring about twelve inches, and the smaller one about eight. The extra-scriptural content of the Jerome maps belongs to the oldest type of post-Ptolemaic mappe monde. Plinian material is largely used, sometimes in a manner that reminds one of Solinus, while some reference is apparently made to a Roman road-map, similar to the Peutinger Table.

An example of the circular map is afforded by the Psalter map, dating from about 1250. The title is explained by the fact that the map was found in a Psalter. Its size is extremely small, being less than four inches in diameter. In treatment the map is distinctly Christian. Jerusalem occupies the center; at the top appears a picture of Christ with angels on either hand swinging censers. The whole design of the map is a highly developed but scientifically debased example of semi-mythical geography--an elaborate exposition of strictly medieval habits of thought applied to geography.[11] Along with the Hereford and larger Jerome maps the Psalter map is, however, of peculiar value in filling in a more complete picture of the Far East.

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[9] Ibid., p. 559.

[10] Beazley, op. cit., II, 566.

[11] Ibid., p. 618.

In closest relation to the Psalter map is the Ebstorf map,[12] which is probably its junior by at least half a century, but does not have a number of old names which are shown on the first map.

The Hereford mappe monde--a giant "wheel" map preserved in Hereford Cathedral--dates from the latter half of the thirteenth century. It has been attributed to Richard of Haldingham. The map has a diameter of over four feet and represents an elaborate piece of ecclesiastical draftsmanship. The Holy City is placed in the center, the terrestrial paradise is shown at the extreme east (top); the key of the whole conception is consequently biblical. Some of its more striking peculiarities are the introduction of the Niger as a great river having no outlet to the sea; streams connecting the Black Sea with the neighboring ocean on the north; the Mediterranean liberally supplied with islands, fishes, the legendary Scylla and Charybdis, the labyrinth of Crete, and the Pillars of Hercules. In a final rapid appraisal of both the Hereford and Ebstorf maps Professor Beazley qualifies them as "monstrosities," and recalls that both belong to the last years of the thirteenth century; are both related to the Psalter map of about 1250; drew their content very largely from the standard manuals of Dark Age learning, and had their first scientific Bible made up of excerpts from Pliny and the Antonine Itinerary, from Orosius and Ulartianus Capella, from Solinus and the Aethici, from the Alexandrian Romance, and from the Bestiaries and Herberia.[13]

Another obscure though deeply interesting family of medieval maps dates from the tenth century. It is more than anything else circular or wheel-like in shape, and is composed of the interrelated designs of Lambert of St. Omar, the "Macrobius" and "Sallust" map illustrations, and the "Climate" and "T-O" sketches.[14] The "Climate" or zone diagrams illustrate the division of the earth's surface from north to south according to the major climate belts. These sketches are chiefly identified with Lambert, canon

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[12]See Richard Uhden, "Gervasius von Tilbury und die Ebstorf Weltkarte," Jahrbuch der Geographischen Gesellschaft zu Hannover, (1930), pp. 185-200; see also Konrad Miller, Die Ebstorfkarte, eine Weltkarte aus dem 3. Jahrhundert (3te Auflage; Stuttgart, 1900).

[13]Beazley, op. cit., III, 528.

[14]Beazley, op. cit., II, 570.

of St. Omar, and with Ambrosius Aurelius Macrobius. The curious variety of "T-O" maps is not only very numerous, but also very uniform in character. At least eighty manuscripts reaching from the eighth to the fifteenth century contain designs of this type. The conception of one and all is fully expressed in the lines written by the Italian poet Leonardi Dati in 1422:[15]

> Un T entre a un O mostra il disegno
> Como in tre parte fu diviso il mondo.

In fine, these diagrammatic sketches are circular or wheel-like in form and have their area divided into three segments made by the intersection of two lines roughly resembling a capital "T". The sections approximately represent the division between Europe, Africa, and Asia.

The earliest among the T-O map examples of the Middle Ages are to be found in the works of St. Isidore. They may in a measure be considered as typical of all the others.[16] Here, besides the three continents--Europe, Africa, and Asia--there are the names of the three sons of Noah, one patriarch being attached to each continent; the East is at the top; the Mediterranean Sea occupies the whole of the T-formed intersection of the land. Other specimens develop the simple titles of Asia, Shem, and the like, by explanatory inscriptions which declare, for example, that Asia is named after a Queen Asia, and is inhabited by twenty-seven peoples; that Africa is derived from Afer, a descendent of Abraham, and has thirty races with three hundred sixty towns.

Only one other T-O sketch is deserving of mention, namely the Byzantine sketch of 1110, now at Oxford, which is one of the earliest plans placing Jerusalem at the center of the earth.[17] Internal evidence seems to warrant the conclusion that this is a copy, poorly executed, by an ignorant scribe in Western Europe, of a Byzantine work brought back by one of the Crusaders about the year 1100.

Lastly, a group of maps which have the common authorship of Matthew Paris conveniently closes the cartography of the

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[15]Excellent reproductions of the map sketches which accompany Dati's poem Sphera, from which these lines were taken, occur in Nordenskiold Facsimile-Atlas, plates ii-iii.

[16]Beazley, Ibid., p. 577.

[17]Beazley, op. cit., II, 578.

twelfth and early thirteenth century. Matthew Paris (1195-1259), the chief historiographer of St. Alban's Abbey, England, appears as the author of six geographical designs--a world map, in two slightly different forms; a map of England in four variants; and other less significant maps and plans.[18] His maps of England give real evidence of critical study. They contain altogether some two-hundred and fifty place-names and are, in fact, remarkable instances of what Ptolemy called chorography or regional geography.[19] Of even greater importance is the medieval map of Great Britain which is now in the Bodleian Library at Oxford. Its author is unknown, and it dates from about the year 1300. The map is on sheep-skin measuring about two by four feet, and is drawn in colors. As far as is known, this map remained the best map of England for some two hundred or three hundred years.

On the whole, these medieval mappae mundi contributed nothing to the progress or development of the modern map. The justification for their study derives from the opportunity they offer to supplement and correct our ideas of that category of medieval thought which was concerned with a knowledge of the world. The greatest obstacle to their study is, however, the lack of a sufficient number of published facsimiles. When in 1849 the Vicomte de Santarem published the first volume of his famous work on medieval cosmography and cartography he enumerated only twenty-three medieval maps, and of these only eight were complete, the remainder being merely fragments. In his great atlas--now very scarce--he published reproductions of 117 medieval mappae mundi, thus laying the foundation for their study. But nothing approaching Santarem's work in importance appeared thereafter until about 1895, when Konrad Miller, of Stuttgart, published his six-volume work of Mappaemundi, die aeltesten Weltkarten. These volumes deal with some two-hundred examples (with seventy reproductions) and today are the standard work on the subject. The value of the work is mainly due to the thorough examination of certain of the larger maps--such as the Ebstorf and Hereford--and to the

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[18]See the article by J. B. Mitchell, "The Matthew Paris Maps," which forms one of three articles, by as many writers, under the title of "Early Maps of Great Britain," Geographical Journal, LXXXI (January, 1933), 27-45.

[19]Beazley, Ibid., p. 585.

comparative study of some of the smaller and less known groups of maps.

A more recent search in England and on the Continent has increased the number of known medieval mappae mundi to some six hundred examples, ranging in date from the eighth to the fifteenth century.[20] It is hoped to have these maps eventually published in facsimile.

## Portolan Charts[21]

Another and completely different method of cartographical representation must be noted as falling within this period. It was in the thirteenth century, or perhaps even earlier that Italian and Catalan mariners began to supplement written sailing directions by drawn charts. The contrast between these charts and the confused, inaccurate, often symbolical and fantastic, and always theoretical and diagrammatic medieval mappae mundi we have just noted, is most striking. Indeed, the work of these marine cartographers, although strictly limited in scope, stands out conspicuously as the earliest attempt to produce a map of practical utility. Their product is sometimes referred to as "compass chart or loxodromic map," but is more properly called "portolan chart."

Little is known of the exact origin of these charts; but it is evident that they are the work of practical navigators, and it is probable that they were first pieced together from the practical coastal-sketches of pilots, especially of Genoa, who through long experience were well acquainted with the trade routes of the Mediterranean.

Just as little is known of the precise moment at which this epochal development in the history of cartography first took shape. It is perhaps safe to assume that the earliest complete nautical chart of the Mediterranean and Black Seas was put together

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[20]Andrews, op. cit.

[21]See especially: Adolf Erik Nordenskiöld, Periplus, an Essay on the Early History of Charts and Sailing Directions (Stockholm, 1897); the bibliographical notes and references are abundant and helpful; see also Konrad Kretschmer, Die italienischen Portolane des Mittelalters . . . . (Berlin, 1909); and the various writings of Edward Luther Stevenson dealing with portolan charts.

in the latter half of the thirteenth century, although no dated example of this early period has come down to us. It is certain, however, that the work was complete by the end of that century, for the model then in use was copied with but little alteration, except in detail, for the next three hundred years.[22] But there can be no question of one man, one year, or one decade having produced this type of design. It did not spring from any school or any example of medieval student-map. It came about as a practical answer to a timely problem.

Since the portolan chart is essentially a sailing-chart it is concerned almost entirely with coastal forms, with headlands and river mouths, and adjacent islands and seaports. Technically, the charts were constructed by means of bearings taken from prominent physical features and by estimated distances. Distance scales, with the same measure of length, occur on all the portolani. But the most characteristic feature of the charts is the presence of groups or systems of rhumb-lines radiating from a common center, the central group of which is generally encircled by eight or sixteen satellite groups. This network, in contrast with nearly every other feature of the portolan map-type, varies infinitely; hardly any two examples give the same system of loxodromes.[23]

A striking characteristic of the charts is their remarkable relative accuracy in the representation of the Mediterranean basin. Outside of the Strait of Gibraltar, there were often included in these charts parts of the western seaboard of Europe, the northwestern coasts of Africa, and the Atlantic islands; but here accuracy and fixity of form was less pronounced, indicating clearly that these regions had not been mapped for as long a period as the Mediterranean basin. It seems probable, however, that if the "normal" portolan chart, as stated by Nordenskiöld, included anything beyond the western limits of the Mediterranean, it extended only so far as Cape Finistère in the North and Cape Nun in the South. Many later chart examples go indeed no further. But a gradual extension of geographical knowledge towards the

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[22]Michael C. Andrews, "The British Isles in the Nautical Charts of the XIVth and XVth centuries," Geographical Journal, LXVIII (December, 1926), 474.

[23]Beazley, op. cit., III, 514.

north and south along the Atlantic seaboards of Europe and Africa may well be traced in the charts of both Italian and Catalan cartographers, and such an attempt has recently been made with respect to the British Isles, and especially Scotland.[24] After the great discoveries in the fourteenth century by Henry the Navigator, Bartholomew Diaz, Vasco da Gama, and Columbus, the scope of the portolan chart was extended to include the whole of Africa and parts of the two Americas and eastern Asia. It thus approached more nearly to the character of the true world map.

A few of the most outstanding of these charts may be briefly noted. Perhaps the most ancient existing specimen of portolan workmanship is the Carte Pisane dating from about 1300.[25] It is very inferior to the more developed portolan charts of the next half century. Far more complete and expert is the portolan map attributed to a priest of Genoa, named Giovanni da Carignano. It dates from the early years of the fourteenth century.[26] It shows the Black Sea in its entirety, with a general contour little inferior to that of the Mediterranean. Parts of the British and Irish coasts are shown with surprising excellence. Scandinavia, though clearly outside the horizon of detailed knowledge is shown as a peninsula for the first time in existing cartography.[27]

The earliest dated portolan chart that has survived is credited to Petrus Vesconte of Genoa. Its date is 1311. Four later portolans also bear Vesconte's name, and it is believed that he was the real or co-author of the curious maps to be found in the Liber secretorum fidelium crucis, written by Marino Sanudo of Venice, and presented by him to the Pope in 1321.[28]

A distinct advance in the representation of the land interior is shown in the large portolan chart constructed by

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[24]Michael C. Andrews, "Scotland in Portolan Charts," Scottish Geographical Magazine, XLII (1926), 129-53, 193-213, 293-306. More than four hundred portolan charts are here noted and classified.

[25]Beazley, op. cit., III, shows a small reproduction of the map, facing p. 518.

[26]Ibid., p. 519, a reproduction of the map is given.

[27]Beazley, op. cit., III, 519.

[28]See Konrad Kretschmer, "Marino Sanudo der Ältere und die Karten des Petrus Vesconte," Zeitschrift der Gesellschaft für Erdkunde zu Berlin, XXVI (1891).

Angelino Dalorto of Genoa in 1325.[29] Whether the Dalorto who drafted this chart was the same person as Angelino "Dulcert" who composed in 1339 in the "city of the Marjorcans" another portolan of great merit, is still an open question.[30]

The Laurentian portolano or Medicean Atlas of 1351 is in some respects the most remarkable of medieval map productions.[31] It consists of eight map sheets, bound in one volume. The sheets represent, respectively, the world as far east as the middle of the western coast of India; the Mediterranean basin and the "normal" portolan area; the specially-treated regions of the Archipelago, Adriatic, and Caspian. The general shape of Africa, its southern projection towards the Cape, and especially the great line of the Gulf of Guinea are represented with a real approach to accuracy. Beginnings of an Indian peninsula may be deduced from the contour of South Asia. The lake and river system of Europe is realized with uncommon clearness, at least in some particulars. There are many other noteworthy features. The author of the atlas is not known, although internal evidence points to a Genoese origin.

Save for the Marjorcan chart of 1339, the mappe monde of 1375, made for King Charles V of France, and commonly known as the Atlas Catalan, is the earliest certain portolan product of Catalan provenance.[32] It is a magnificent piece of work, and gives more fully than any other plan of the Middle Ages the results won by the great overland travellers. The peninsular character of India, only partially suggested on the Laurentian portolano, is here truly exhibited. The position, extent, chief divisions, towns and rivers of China are first approximately represented. Conspicuous excellence is displayed in the interior of Mongolia and India. In its treatment of the Atlantic islands--the Azores, Canaries, and the Madeira group--the atlas is more complete than

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[29]See the Portolan Chart of Angelino Dalorto, 1325. . . . . With a note on the surviving charts and atlases of the 14th century by Aurhur R. Hinks (["Reproductions of Early Manuscript Maps," I]. London: Royal Geographical Society, 1929).

[30]See E. T. Hamy, La mappemonde d'Angelino Dulcert, de Majorque, 1339 (2 ed.; Paris, 1903); a reproduction of the map is included.

[31]Beazley, Ibid., p. 523.

[32]Beazley, Ibid., p. 525.

any earlier work.

The Catalan Atlas represents the zenith of medieval map work. In none of the later and remaining charts of the fourteenth century is any addition made to earlier knowledge of the Atlantic islands or of the west African coast; in none of them is the treatment of other portions of the world-surface original or remarkable enough to attract notice by the side of the Laurentian portolano and the Catalan Atlas.

It is true that the portolano charts were in their time ignored by the "learned" cartographers who continued to rely on ancient models. Nevertheless, these "practical" marine charts and the "scientific" writings of Ptolemy, soon to be rediscovered, were the two chief elements from which sprang the modern map.

## CHAPTER III

## THE BEGINNINGS OF MODERN CARTOGRAPHY

The rediscovery of the writings of the ancients, and especially of those of Ptolemy, finally set a halt to the long centuries of stagnation and regression in scientific cartography. Ptolemy's great work, his Geographia,[1] first became known to western Europe after Jacobus Angelus de Scarparia had translated it into Latin in 1409. The first printed edition of this version appeared in Vicenza in 1475, and a second edition, supplemented by twenty-seven maps, appeared in Rome three years later.

That the original work of Ptolemy was supplied with maps based on the earlier productions of the Tyrian school can hardly be doubted. Whether the maps as we now know them in manuscripts dating from the thirteenth to the fifteenth century, and in numerous printed editions, represent those originals is not so absolutely certain. The preservation of these maps is ascribed to a certain Agathodemon who is said to have flourished in the sixth century. However, the present form of the twenty-seven ancient maps is due to Dominus Nicolaus Germanus, who about 1466 redrew them on a trapezoidal instead of an earlier cylindrical projection.

How tremendously popular the work of Ptolemy at once became may be judged from the fact that some six or seven editions of it were published before the end of the century.[2] It came,

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[1]The best English version of the Geographia is the translation by Edward Luther Stevenson, entitled Geography of Claudius Ptolemy . . . . (New York: New York Public Library, 1932). The work is preceded by an introduction of Professor Joseph Fischer who gives his reasons for assuming that the twenty-seven maps which supplement this volume reproduce the original Ptolemy designs; see also the invaluable Nordenskiold Facsimile-Atlas.

[2]See Henry Newton Stevens, Ptolemy's Geography, a brief Account of all the Printed Editions down to 1730 (London, 1908). Note: The precious collection of Ptolemy editions listed in this volume is now part of the "Ayer Collection" of the Newberry Library, Chicago, Illinois.

moreover, to hold rank as the standard text-book on geography for upwards of two hundred years.

## The Geographical Conceptions of Columbus

The rediscovery of the works of Ptolemy had a decisive influence on Columbus and his attempt to reach Asia by way of a western ocean route. It was through Ptolemy's writings that Columbus learned of the critical, though highly fantastic figure of 225° which Marinus of Tyre had declared to represent the actual east-to-west spread of the habitable world. Most of his knowledge of Ptolemy Columbus gained from his perusal of Cardinal d'Ailly's Compendium cosmographia, written about 1413 or 1414.[3] Even more influential was another work by d'Ailly, namely his Imago Mundi[4] first published in manuscript in 1410, and printed in Louvain between 1480 and 1487, according to Vignaud. In this work, of which Columbus made considerable use, d'Ailly quotes and uncritically discusses at length the opinions of such great men among the ancients as: Aristotle, Seneca, Pliny, St. Jerome, the Arabian philosophers Alfragan and Averroes, and particularly Friar Bacon--all of whom were favorable to the existence of a widely extending habitable world. D'Ailly incorporated long passages verbatim from Roger Bacon's Opus Majus. Here Bacon, basing himself on Alfragan, develops at length the thesis that Ptolemy's limit of 180° for the width of the habitable world was much too low, and that the distance between the most westerly point of Africa and the most easterly point of Asia across the intervening ocean could only be relatively small. And it was the unquestioned authority of the ancients more than any other theoretical consideration which persuaded Columbus of the correctness of the Marinus' figure respecting the size of the habitable world. In a letter to Ferdinand and Isabella Columbus gives frank expression to his

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[3]Henry Vignaud, Histoire critique de la grande entreprise de Christophe Colomb (2 vols.; Paris, 1911), I, 99.

[4]Pierre d'Ailly, Imago Mundi . . . , edited by Joseph Pierre Buron (3 vols.; Paris, 1930-31). Includes Latin and French texts, the marginal notes of Columbus, and a study of sources. See also the review by E. G. R. Taylor of this work in the Scottish Geographical Magazine, XLIX (1933), 214-19, where Miss Taylor adds a free translation of passages, in Roger Bacon's Opus Majus, favorable to the notion of a "narrow" Atlantic.

beliefs in this respect. He says: " . . . . Ptolemy believed that he had well corrected Marinus, who is now found to have been very near the truth. . . . . The world is small. The dry land is six parts of it; the seventh only is covered with water.[5] I say that the world is not as great as the vulgar believe, and that a degree from the equinoctial line is 56 2/3 miles; easily this may be proved exactly."[6] In view of the peculiar and fantastic notions entertained by Columbus with respect to the nature and magnitude of the task before him, there has long been open dispute on the question of the degree of credit which should in justice be accorded him as the discoverer of the New World. On this point there was diversity of opinion even during his lifetime. And today it is still being argued whether Columbus really conceived of the project which he carried out, as a result of his own thought and experience; whether he was a man of exceptional intelligence; and whether he had indeed, as he claimed, achieved something which no other man could have achieved.[7]

## The Map of Columbus

The map which Columbus used on his epochal voyage has in particular given rise to controversy. Many historians have attributed it to the learned Florentine astronomer, Paolo Toscanelli (1397-1482). It has even been claimed that the entire conception of a westward approach to Asia originated with the latter. The evidence upon which these claims rest is primarily based upon a letter supposedly written by Toscanelli in 1474. It is specifically asserted that this letter contained a detailed description

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[5]Columbus' authority for this statement is Esdras, i.e., the first two books of the Apocrypha. The figure of 56 2/3 miles as representing the linear measure of one degree of arc was first given by Alfragan. Columbus learned of it in the Imago Mundi of d'Ailly who had, in turn, lifted it from Roger Bacon's Opus Majus.

[6]Quoted from Select Documents Illustrating the Four Voyages of Columbus . . . . , translated and edited with additional material, and introduction and notes by Cecil Lane. Vol. II: The Third and Fourth Voyages (["Hakluyt Society," 2d ser., No. LXX] London, 1933).

[7]The ablest re-statement and critical appraisal of the whole controversy is given by Cecil Lane in the "Introduction" to his first volume of Select Documents . . . . (vide supra), ([Ibid., 2d ser., No. LXV] 1930), pp. xiii-cl; bibliography, pp. cli-clv; the bibliography is exhaustive with respect to the most important works on the subject.

of a western route to Asia and that it was accompanied by a map. It is further claimed that a copy of the letter and the map were sent to Columbus, though just when and under what circumstances is not so certain. Henry Vignaud has written elaborate volumes to prove that the whole story of Columbus and Toscanelli is a fabrication, and that any claim concerning a western voyage of Columbus, based on the arguments drawn from Toscanelli's map, is unsound. Vignaud thereupon set out to establish a new version of the genesis and the accomplishment of the project of Columbus. This he did with much erudition and infinite patience, although his theory has failed to win any wide acceptance.[8] Since the map of Columbus has unfortunately not survived, its absence will no doubt continue an incentive to further research and controversy.

## The Nearest Approach to the Map of Columbus: The Behaim Globe

The loss of the mappe monde of Columbus, although serious, is fortunately somewhat compensated by the survival of the famous Behaim Globe of Nuremberg, which dates from the year 1492.[9] It has been pronounced as "without comparison the most important geographical document since the atlas of Ptolemy." The globe measures about twenty inches in diameter and is constructed of pasteboard covered with whiting and parchment. Here, as on the map of Columbus, the ocean separating Europe from Asia is approximately 130° wide. Apparently, both Columbus and Behaim drew their information as to the extent of the known world from the same sources, namely, the Imago Mundi of d'Ailly, and the writings of Ptolemy. The great claim of the globe to distinction has been stated to be due to the fact that it was "first to adopt unreservedly the existence of the antipodes; first to show clearly that there was a passage from Europe to India; and first to deal with the discoveries of

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[8]For a destructive criticism of the arguments of Vignaud, see Cesare de Lollis, Cristoforo Colombo nella legenda e nella storia (Milan; Rome, 1931); see also, L. Gallois, "La cartographie du moyen âge et la carte attribuée à Christophe Colomb," Revue historique, CLIII (September 1926), 40-51; and Paul Kahle, Die verschollene Columbus-karte von 1489 in einer türkischen Weltkarte von 1513 (Berlin, 1933).

[9]See Ernst George Ravenstein, Martin Behaim, His Life and His Globe . . . . With a Facsimile of His Globe . . . . (London, 1908); see also G. H. Kimble, "Some Notes on Medieval Cartography with Special Reference to M. Behaim's Globe," Scottish Geographical Magazine, XLIX (1933), 91-98.

Marco Polo." The globe represents thus the geographical knowledge of the time immediately previous to the first voyage of Columbus. It is not believed, however, that Columbus had knowledge of the existence of the globe at Nüremberg.

## CHAPTER IV

## TRANSITIONAL CARTOGRAPHY IN THE SIXTEENTH AND SEVENTEENTH CENTURIES

The geographical concepts that were current on the eve of the age of the great discoveries were but little different from the philosophical speculations of the ancient Greeks as made known especially through the writings of Strabo and Ptolemy. But under the practical impulse of the epochal exploratory discoveries and the vigorous stimulus to scientific investigation that followed in the wake of the Renaissance, cartographic methods began in the sixteenth century to pass through a development transitional between the primitive and the strictly scientific stage of map-making. This development is, moreover, chronologically identified with the pre-eminence in cartographic production attained first by Italy, and later by the Low Countries and France. Thus, with a few exceptions, such as the Ptolemy editions of Ulm (1482 and 1486) and a few more or less separate maps that were printed in Germany[1] in the fifteenth or early part of the sixteenth century, all the geographical maps until 1513 were printed in Italy.[2] From that year on, however, Italy's hitherto undisputed lead in map production gradually shifted to the northern countries of Europe.

The reform movement in cartography in the sixteenth century began to take shape about the middle of the century. Theoretically it began with the doubt which came gradually to be cast on the infallibility of Ptolemy and the reliability of his map data. Practically, it resulted in the shift to actual topographical investigation and the invention of improved methods of projection. The names[3] most prominently identified with this reform

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[1]See Lucien L. J. Gallois, Les géographes allemands de la renaissance (Paris: E. Leroux, 1890). Pp. 266.

[2]Nordenskiöld, Facsimile-Atlas, p. 98.

[3]The work of these and other important sixteenth century cartographers is fully dealt with in the scholarly articles by Professor Bagrow, noted in footnote 6, infra.

movement were, in Germany: Philip Apian (1531-1580); in Italy: Gastaldi; and in the Low Countries: Mercator and Ortelius.

## Cartographic Pre-eminence in the Low Countries: Mercator; Ortelius; Blaeu, etc.

Among the contributions made to cartography by these reformers that associated with the name of Mercator in the Low Countries stands out as the most famous of all.[4] It was in connection with his large map of the world, first published in 1569 at Duisburg, Germany, that Gerhard Mercator (1512-94) introduced his new isogonic-cylindrical projection which has ever since been known by his name.[5] This is a type of projection with equidistant meridians and parallels, so drawn that a proper ratio is always maintained between the longitudes and latitudes. The mathematical principles on which it is based and the tables necessary for its construction were first published by the Englishman, Edward Wright, in 1599 in a work entitled: The Correction of Certain Errors in Navigation Detected and Corrected. This type of projection is especially well adapted to marine charts and is in use today.

The publication at Antwerp, in 1570, of the Theatrum Orbis Terrarum of Abraham Ortelius (1527-98), the friend of Mercator, marks also the definitive shift of cartographic pre-eminence from Italy to the countries north of the Alps. The Theatrum represents historically the first systematic and scholarly collection of modern engraved maps and has been very aptly designated "the first modern atlas." Fifty-three plates of double-folio size were contained in the first edition, but in later editions, of which there were many, this number was much increased. Thus in the last edition, issued in 1612, the number of maps had increased to 128 modern and some twenty-eight ancient or historical specimens. The great fame that is attached to this atlas is not merely due to the fact that Ortelius was first in collecting all available map material but that he did so with such discernment and skill as to supplant definitely Ptolemy's classical work. No small part of the

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[4]Cf. Fern. van Ortroy, "Bibliographie sommaire de l'oeuvre mercatorienne," Revue des Bibliothèques, Pt. I: Vol. XXIV (1914), 113-48; Pt. II-III: Vol. XXV-XXVI (1915-16), 9-30, 119-41.

[5]For an excellent description of this and other important projections, see Charles H. Deetz and Oscar S. Adams, Elements of Map Projection with Applications to Map and Chart Construction (3d ed.; U. S. Coast and Geodetic Survey: Special Publication No. 68; Washington: Government Printing Office, 1931). Pp. 173; maps; bibliography.

value of his work is due, moreover, to the Catalogus Auctorum[6] which supplements the atlas, for it constitutes a precious directory of the cartographic personalities of the time. It may also be noted that Ortelius issued, besides his opus magnum and his rare map of the world (1564) in eight sheets (a copy is in the British Museum), a large separate map of Spain in six sheets on data compiled by Charles de L'Ecluse.

The Mercator; Hondius-Mercator; and Jansson Atlases

The success of the Theatrum of Ortelius led to the production of other similar works. The atlas of Mercator had been planned almost simultaneously with that of Ortelius but it was not published in volume form until one year after his death and then only in a preliminary edition. The first complete edition of the Atlas of Mercator was issued for his heirs by Bernard Busius of Dusseldorf in 1602. Mercator's plates next passed into the hands of Jodocus Hondius (1563-1611) of Amsterdam, who in 1606 brought out the first edition, augmented by fifty maps of his own and of others, of the monumental series of Hondius-Mercator atlases.[7] As a manual of practical cartography this atlas soon supplanted entirely the Theatrum of Ortelius.

On his death in 1611 Jodocus Hondius was succeeded by his son Henrick who in partnership with his brother-in-law, Jan (Joannes) Jansson (1596-1664), continued the publication of the atlas. When Henry died in 1644 or 57, Jan Jansson came into complete control of the establishment and produced many magnificent

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[6]See Leo Bagrow, "A Ortelii Catalogus Cartographorum," Teil (A-L). Petermanns Mitteilungen, Ergänzungsheft, No. 199 (1928); Teil (M-Z): Ibid., No. 210 (1930). These articles are among the most important contributions made in recent years to the history of sixteenth century mapping. Bagrow traces and describes in chronological order all the known productions of each of the authors mentioned in the Catalogus and notes the circumstances under which their work was done, discussing the questions still remaining obscure, and stating the places where the original maps or modern facsimiles are to be found.

[7]For a list of these atlases, see the bibliography of F. van Ortroy, op. cit.; and also Phillips, op. cit., title 3400, and title 422 where a tabular list of the various Mercator atlases is given; see also the splendid reproduction of the Jodocus Hondius Map of the World on Mercator's Projection, 1608, issued, in twenty-six full size sheets, supplemented by a memoir of twenty-three pages, by the Royal Geographical Society, London, 1927.

volumes in his own name,[8] in addition to the work which he did on the Hondius-Mercator series. Jansson had collaborated with Henry Hondius in the preparation of the second volume of the Hondius-Mercator atlas, entitled L'Appendice de l'Atlas de G. Mercator et J. Hondius; in 1642 Jansson issued a third volume, and in 1646 volume four appeared containing a description of England in Latin, taken from Camden's Britannia, accompanied by maps of the counties of England and Wales, compiled from those of Saxton and Speed. This completed Jansson's atlas in four volumes, dated 1638-47. Enlarged editions in five and six volumes were issued subsequently in Dutch, French, German, Latin and Spanish. Later in the century the Jansson, or Jansonius establishment was taken over by Pieter Schenk who in circa 1683 republished the atlas including the English county maps.[9]

Another atlas of the Theatrum type was the Speculum Orbis Terrarum first published in 1578 by Gerardi de Judaeis and containing some thirty-eight maps drawn or copied at Antwerp.[10] This work also has a lasting place in cartographic literature because the authorship of the maps is generally indicated. Mention may be made here also of the first collection of marine charts, the Spiegel der Zeevaart, which was published in 1595 at Leiden by Jucas Janszon Waghenaer of Enkhuizen. This work passed through several editions and was translated into a number of foreign languages.

## The Blaeu Atlases

Considerable fame attaches itself to the great rival firm of the house of Jodocus Hondius and Jan Jansson, the Blaeus of Amsterdam.[11] This firm was founded by Willem Janszoon Blaeu

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[8]See Pieter Anton Tiele, Nederlandsche Bibliographie van Land-en Volkenkunde (Amsterdam: Fr. Muller, 1884), pp. 121-23, where a list of the Jansson map publications is given; see also the various entries in Phillips' list.

[9]Thomas Chubb, Printed Maps in the Atlases of Great Britain and Ireland; a Bibliography, 1579-1870 . . . . (London, 1927), p. 435.

[10]Phillips, op. cit., title 383.

[11]On the Blaeu atlases see the helpful list, notes, and references, under title 119, in Woodbury Lowery's Descriptive List of Maps of the Spanish Possessions with the Present Limits of the United States, 1502-1820, edited with notes by Philip Lee Phillips (Washington: Government Printing Office, 1912).

(1571-1638) in 1612 and was continued by his sons Jean and Cornelius, and his grandsons. The business was at first carried on under the name of Willem Janszoon, with the result that Blaeu was often confused with his rival Jansson. The elder Bleau first attracted attention in 1605 with his map of the world.[12] He published thereafter many other maps, and in 1630 collected them into his first terrestrial atlas, Atlantis Appendix, sive pars altera continens tab. geographicas diversarum Orbis regionum nuc, primum editas (Amsterdam; Apud Juijelmum Blaeuw, Anno 1630). A second edition of this was published in the following year under a new title, Theatri A. Ortelii et Atlantis G. Mercatoris... (Amsterdam... 1631). A copy of the first edition is in the possession of the British Museum and is believed to be unique. In 1635 Bleau issued his Theatrum Orbis Terrarum, sive Atlas Novus which was enlarged and reissued by his son Jean, in various languages and with a wealth of skill rarely equalled since, as the Atlas Major. This great atlas reached as many as six volumes by 1655 when it comprised some 372 maps. Between 1659 and 1672 the atlas was issued with Spanish text in ten volumes, exclusive of the American parts. Between 1662 and 1665 a Latin edition entitled Atlas Major sive Cosmographia was published in eleven volumes--the last volume containing approximately twenty-three American maps. A French edition in twelve volumes was issued in 1663 and a Dutch edition, somewhat abridged, in 1664-65. In 1672 the Blaeu establishment burned down and what little was saved of the plates passed into the hands of Frederik de Wit. This latter firm, which lasted until 1712, produced about three hundred eighty maps and thirty sea charts, all of a high standard of workmanship.

## French Cartography of the Seventeenth Century: The Sanson and Jaillot Families[13]

Almost contemporaneous with the development of cartography in the Low Countries was the rise to cartographical eminence of

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[12]Cf. Edward Luther Stevenson, William Janszoon Blaeu, 1571-1638; a sketch of his life and work, with an especial reference to his large world map of 1605 (New York: Hispanic Society of America, 1914).

[13]Biographical and bibliographical data on the Sanson and Jaillots families may be found in Herbert George Fordham's booklet, Some Notable Surveyors and Map-Makers of the Sixteenth, Seventeenth, and Eighteenth Centuries and their Work (Cambridge: The University Press, 1929), pp. 23-38; see also Woodbury Lowery, op. cit., title 136.

the French School of Sanson and Jaillot. It is true that as early as 1592-94 an attempt was made under the auspices of Maurice Bouguereau to compile a national atlas of France,[14] and that Gabriel Tavernier of Amsterdam was intrusted with the task of engraving the maps of certain of the provinces of France. The maps were published in 1594 as Le Théâtre Francois and were republished with certain additions from time to time. But these maps were nearly all based on Dutch originals, so that no claim to distinction, except that of priority, can arise here by a comparison with the cartographic originality of the Sansons.

Nicolas Sanson (1600-67), the founder of the French school of cartographers, was born in 1600 at Abbeville in Picardy and died in 1667 in Paris. His earliest complete collection of maps, made up of both a printed title page and a printed list of contents, is of the year 1658. It is a general atlas of some 113 titles and was published at Paris with the heading which reads in part as follows: Cartes générales de toutes les parties du monde, ou les empires, monarchies, républiques, estats, peuples, étc. de l'Asie, de l'Afrique, de l'Europe, et de l'Amérique ... sont exactement remarqués, et distingués suivant leur estendue. The influence of these maps was very great for they were copied extensively not only in France but also in England and on the Continent.

It is proper to note, as part of the earlier cartographic output of Sanson, the small quarto atlases which were issued separately for Europe, Asia, and America, with interleaved descriptive text. The first volume of these appeared in 1648; it covered Europe. Asia followed in 1652, and Africa and America in 1656. Each atlas went through several successive issues. In all, Sanson published, it is believed, more than three hundred maps.[15]

The work of the elder Sanson was carried on after his death by his two sons, Guillaume (d.1703) and Adrien (d.1718), and they, in association with the first member of the Jaillot family of geographers, Alexis Hubert Jaillot,[16] no doubt accumulated

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[14]See Ludovic Drapeyron, "Le premier atlas national de la France, 1589-94," Bulletin de géographie historique et descriptive, No. 1 (1890).

[15]See the various entries in Phillips' List of Geographical Atlases; also Woodbury Lowery, op. cit., title 136.

[16]Cf. Claude Francois Roland, Alexis-Hubert Jaillot, Géographe du Roi Louis XIV (1632-1712) (Besancon, 1919).

additional cartographic material. The very large folio atlases of the Jaillots which began to appear about 1689 in a number of successive issues were founded on Sanson's original maps and accumulations. The atlases bore the title Atlas Nouveau ... The 1696 edition of this atlas, edited by Pierre Mortier of Amsterdam, is in two volumes containing 136 maps.[17]

The atlas may be said to give a fair résumé of French cartographic accomplishments up to that time. The maps designed by Jaillot and his co-workers mark, however, the terminal point as regards the generally inaccurate delineations upon maps of longitudinal measurements. The atlas of Jaillot was soon to give way at the commencement of the eighteenth century to the more exact and scientific results achieved by Guillaume Delisle and others who constructed their maps with a knowledge of the progress made by astronomers in fixing the exact positions of locations on the earth's surface.

Jaillot's maps are distinguished artistically in association with design and coloring, by charming title-panels, or cartouches, which are drawn illustrative of natural features, special produce, industries, or other characteristic items of the area represented on the map. These features present infinite variety and have even attracted the attention of collectors, though many maps have been destroyed as a result. The decoration of the sea-surface with ships and marine monsters, and of the land-surface with more or less fictitious animals, disappears in the course of the seventeenth century and is altogether wanting on the Sanson-Jaillot maps.

As a definite epoch in map construction, the French school of cartography founded by the elder Nicolas Sanson and terminating with the great atlas of Jaillot, may be said to cover about a half-century, though its influence extended considerably beyond this span.

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[17]Fordham, op. cit., p. 33.

## CHAPTER V

## THE EVOLUTION OF SCIENTIFIC CARTOGRAPHY IN FRANCE FROM THE SEVENTEENTH TO THE NINETEENTH CENTURY

That from the eighteenth century there should finally emerge the modern map, with its accurate representation of true areal relationships as previously determined by precise survey operations in the field, is directly attributable to the fundamental researches and progress made in scientific methods of earth mensuration during the preceding century. Precise measurements of latitude, longitude, and also altitude are essential to the correct determination of position, distance, and direction of the material aspects of the earth surface and their subsequent representation upon maps. It so happened that such measurements came to occupy a prominent place in the seventeenth century because the scientific world of that time began to be greatly preoccupied with the difficult problem of determining the size and shape of the earth. Indeed the origins of modern topographical methods may largely be traced to the methods of investigation developed in connection with the search for a solution of this problem during that time.

### The Emergence of Scientific Survey Methods

It may be recalled that latitude may be determined by measuring the altitude of the sun, the pole star, or the upper and lower culminations of a circumpolar star. In early and later times various instruments, such as the gnomon, the cross or back staff, the astrolabe, etc., were used for this purpose and more accurate determinations of latitude were made possible with the publication in 1627 of the Tabulae Rudolphinae by Johan Keppler.

While latitude may be determined independently of all other points on the globe, the longitude of a point is measurable only by reference to another point. Longitude is defined as the angular distance between a large circle passing through a given point and through the poles, and of another large circle passing through the poles and a fixed point of reference. The large

circles are known as meridians (from meridas, midday) because a perpendicular pole erected anywhere upon them will cast a shadow exactly north or south at midday. The angular distance between these circles is obviously proportional to the time required by the earth to rotate through this distance. For example, in one hour the earth rotates through 1/24 x 360° or 15°. If one knows therefore the difference in local time existing, at the same instant, at any given point and a fixed point of reference, one can at once determine the respective difference in longitude. In other words, the longitude of a given point is measured by the difference between its local time and the time of a fixed point of reference. This point of reference is now generally taken to be that of the Observatory of Greenwich; its time signals are sent out by wireless.[1] Local time is now obtained by the observation with the theodolite of pairs of stars east and west, as near the vertical as possible. It may also be ascertained, along with latitude, by the prismatic astrolabe, or, more laboriously, by a portable transit instrument set up at the given point.[2]

What is essential, therefore, to the accurate measurement of the longitude of local points is a suitable initial or prime meridian of reference and the ability to determine local time so as to be exactly comparable with the initial meridian time. The highly refined instruments required for these measurements have

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[1]The choice of a common initial meridian was for long a matter of great confusion. It may be recalled that Ptolemy made use of the meridian of the Fortunate Islands, vaguely identified as the Canaries. Mercator first fixed upon the Island of Forteventura, in the Canaries, and then upon the Azores as his prime meridian. Ortelius, Jansson, and Blaeu decided upon the Isla del Fuego in the Cape Verde Islands; later Blaeu proposed the Peak of Teneriffe, and in this he was followed by the Dutch. There was in fact no unanimity of agreement in the choice of an initial meridian until in 1634 the government of Cardinal Richelieu and of Louis XIII fixed upon Ferro (Isle de Ferro), the most westerly of the Canaries, as the locality of the French initial meridian. Thereafter the Ferro meridian came to enjoy almost universal acceptance until the beginning of the nineteenth century. In England a vague westerly initial meridian remained in use until 1676 when London was used for the first time as the standard on an English county map, according to Sir Herbert Fordham. Later St. Paul's Cathedral, and finally Greenwich (1794) were universally adopted.

[2]Arthur R. Hinks, Maps and Survey (3d ed.; Cambridge: The University Press, 1933), p. 181.

only become available in comparatively recent times. Up to the end of the sixteenth century, the sun and the rare eclipses of the moon were used in the determination of longitude; but since there were no means of making comparable time observations, the longitude problem could not be solved until suitable instruments were available. It was because of the invention of such instruments in the seventeenth century and their systematic application to earth measurements that the emergence of scientific cartography became at last a fact. Some of the most outstanding contributions made by the seventeenth century in this respect are as follows: the invention of the telescope by Galileo in 1610 and his discovery of the moons of Jupiter in the following year; the invention of logarithms by John Napier in 1614 and their improvement by Henry Briggs in 1624; the invention of the vernier scale in 1631; of the micrometer in 1638-43, and of the barometer in 1643; the application of the principle of the pendulum to clocks in 1656; the invention of the reflecting telescope in 1663 and its improvement by Isaac Newton in 1672; the discovery of the speed of light by Romer, and the publication of tables giving the ephemerides of the moons of Jupiter, by Jean Dominique Cassini in 1668. All these epochal discoveries facilitated greatly the determination of longitude, especially on land. On the seas such measurements did not become either simple or accurate until the invention in 1735 of the Harrison chronometer.

It might perhaps be assumed that the astronomic values of latitude and longitude would be the ones employed for mapping purposes; but this is not the case. Astronomic latitude and longitude depend on the direction of the plumb line and are therefore so affected by local topographic conditions as to render inaccurate any determinations of distance and direction based on astronomic values. Orientation of individual points on the globe is indeed determined according to astronomical values of latitude and longitude, but the measurements of distance, direction, and altitude on the surface of the earth, for the purpose of large scale mapping, are made by triangulation--a method, the first practical application of which dates also from the seventeenth century.[2] In fine, where the triangulated or geodetic values

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[2]The theory seems to have been originated by Gemma Frisius in the early decades of the sixteenth century; see Miss E. G. R. Taylor's article, "The Earliest Account of Triangulation," Geographical Journal, XLIII (1927), 341-45.

are available they are invariably used in preference to the astronomic values, in spite of the conventional and derivative character of the former.

The first application of triangulation, that is, of measuring a base-line and of triangulating from it so as to join two points and to measure the arc subtended by them, was made by the Dutch geometer Willebrord Snellius in 1615. It is true that Snellius made many mistakes and that his instruments were unsuitable to scientific accuracy.[3] But his lasting merit lies in the fact that he laid down the principles of triangulating from a known base--which principles have been followed ever since and were soon to be brought to memorable fruition by the earth-measuring determinations of the newly founded French Academy of Sciences.

## The French Academy of Sciences and the First Scientific Earth Measurements[4]

The establishment of the French Academy of Sciences in the year 1666 marks the beginning of a hundred years of most illustrious French leadership in scientific astronomy, geodesy, and cartography. The recent invention of the telescope and of the pendulum clock, and the compilation of the Cassini tables of the ephemerides of the moons of Jupiter, made possible for the first time the fairly accurate and simple determination of longitude. One of the most important early tasks of the Academy was therefore the making of such determinations. These it made not only of important points in France, but also in foreign countries. The result was that existing maps were proved to be woefully out of alignment. Louis XIV and his able minister, Colbert, anxiously desired to remedy this defect by having the Academy make preparations for a large-scale map, "as accurately as possible," of the

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[3]See John Mathieson, "Geodesy: A Brief Historical Sketch," Scottish Geographical Magazine, XLIII (1926), 328-47.

[4]On this section see the following works: Charles Wolf, Histoire de l'Observatoire de Paris de sa fondation à 1793 (Paris, 1902); Lucien Gallois, "L'Académie des Sciences et les origines de la carte de Cassini," Annales de géographie, XVIII (1909), 193-204; 289-310; and also Christian Sandler, Die Reformation der Kartographie um 1700 (Munich and Berlin, 1905). The Paris Observatory was founded in 1670 (five years earlier than that of Greenwich) and remained for about a hundred years in the practical possession of the French Academy of Sciences. It was not placed under an independent director until 1771.

whole kingdom of France. The task was a most formidable and novel one, for it implied not only the accurate linear measurement of an arc of meridian, but beyond this the determination of the size and shape of the earth. If the earth is assumed to be a sphere, the length of a single meridional arc with the difference of latitude of its end points suffices to determine its size. If, however, the earth is taken to be an elipsoid of revolution, at least two meridional arcs and the latitudes of all end points must be determined. The solution of this difficult problem was placed in charge of one of the most illustrious members of the French Academy, the astronomer Jean Picard (1620-82), who at once set out on his task.

Up to this time the earth was commonly regarded as perfectly round and Picard and the French Academy deemed it sufficient to measure only one degree of meridional arc. This Picard proceeded to do by the only correct method of measuring an arc of meridian, namely that of Snellius. Picard began by measuring a base-line and from it, with the aid of a quadrant fitted with two telescopes, he observed the angles of fifteen main triangles which stretched northward from Malvoisine, near Paris, to Sourdon, near Amiens. The results of his measurements and computations gave the length of a degree of arc equal to 69.037 statute miles, or only about 132 yards less than the modern measurement. It was later found that this high degree of accuracy was really due to the fortunate circumstance that many of the numerous errors made by Picard mutually cancelled out. This new measurement of the earth increased its diameter by about a thousand miles. The underlying data were published by Picard in 1671 under the title of La Mesure de la Terre. They mark a most memorable and all-time contribution to scientific geodetic methods and accomplishments.

But if Picard and the French Academy had indeed succeeded in determining the almost precise length of a degree of arc lying along the eighty-three mile stretch of territory between Paris and Amiens, serious doubt was soon cast upon their claim that all arcs were of equal lengths and that the earth was in fact a perfect sphere. Theoretical and practical investigations made by Isaac Newton and Christian Huyghens led to the conclusion that the shape of the earth was oblate and that the ratio of the polar to the equatorial axis was as 229:230. Huyghens had noticed, for example, that by spinning a ball of soft clay rapidly, the ball enlarged at

the middle and flattened at the poles. These tests together with pendulum observations made at Paris and Cayenne in 1672, confirmed Newton's contention. Since the Picard arc was too short to permit either the confirmation or the denial of Newton's claim, it was decided to extend that arc northward as far as Dunkirk and southward as far as Spain. J. D. Cassini (1625-1712) was placed in charge of the new astronomic and triangulation measurements which were carried on from 1690 to 1718. The results were published in Paris in 1720 by Jacques Cassini de Thury (1677-1756) under the title of Traité de la Grandeur et de la Figure de la Terre, and from these it seemed paradoxically enough to follow that the earth was flattened at the equator rather than at the poles. Dissatisfied with this result, which was entirely due to imperfections inherent in the instruments, the members of the French Academy decided, in order to remove all further doubt, to measure an arc near the equator and another arc near the north pole. Such measurements were made at Tornea, Sweden, and on the Andes (since referred to as the Peruvian Arc) during the years from 1736 to 1746. With the results of these and the French arc measurements finally at hand, the earth's equatorial diameter was computed as equal to 7947.2 miles and the polar diameter as 7902.8 miles. Pendulum observations made near the north pole, the equator, and in France confirmed these findings. The shape of the earth was thus shown to be an oblate spheroid, or rather an ellipsoid, and one of the most contentious questions was settled.

The desire for similar information and measurements now spread rapidly to other European nations, for existing maps as well as international boundaries were badly in need of correction. It was France, however, which most signally crowned her long years of astronomical and geodetic research and leadership by the production of the first topographical map of any country portraying as a whole, on a large scale, its surface and superficial characteristics. It was almost fifty years before another country, England, was ready to launch out with a similar undertaking. Of this first topographical French map, and of other French maps which derived directly from the geodetic investigations of the French Academy, a brief recital will be given in the sections that follow.

## Early Non-Official Map Productions Utilizing Survey Data

The planisphere issued by Jean Dominique Cassini (1625-1712) in 1680 may be considered the first attempt to show upon a world map the results of the French Academy of Sciences' new place measurements. But more significant, by far, was the Carte de France prepared by Lahire and "corrected by order of the King according to the observations of the members of the Academy of Sciences." The map is dated 1684; it incorporated all the numerous place determinations that had been made by the French Academy of Sciences since the date of its establishment in 1666, and showed for the first time the real cartographic boundaries of the kingdom of France. How vast an improvement this map was over maps of the previous period may be seen from a comparison with the Sanson map of France of 1679, which placed Marseilles several leagues too far south, and the city of Brest some thirty leagues too far west, or in the open sea.[5] Another noteworthy cartographical contribution and milestone that had its direct inception in the earth measurements of the Academy of Sciences, was the lay-out in 1696 on the floor of the salon of the Observatory at Paris of a planisphere showing the positions of some thirty-nine localities fixed by recent calculations. This world map was due to J. D. Cassini.

But France was especially fortunate to have available at this time two such eminently gifted and qualified cartographers as Guillaume Delisle (1675-1726) and Jean Baptiste Bourguignon d'Anville (1696-1782), who were capable of giving not only adequate but even superior cartographic expression to the accurate field survey data gathered by French scientists at home and abroad.

Delisle is, in point of time, the first modern cartographer.[6] His map productions number approximately one hundred. They include maps of the world, of the continents, of the European countries, of Canada, Mexico, Florida, Louisiana and the Mississippi River, etc., and also provincial maps of France, and a certain number of historical maps. These maps mark a definite advance

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[5]Fordham, Notable Surveyors, p. 48.

[6]See especially Christian Sanders, Die Reformation der Kartographie um 1700 (Munich and Berlin, 1905); the text is supplemented by a tabular list of the Delisle maps, and also by six map designs.

over all previous map productions; they are indisputable proof of the high scientific competence and the courageous originality of their author. Not only did Delisle, with a spirit of sober discrimination, select material for his maps from every source available, including portolan charts, sailing directions, and travellers' reports, besides making full use of the new place measurements that were continually being made by members of the Academy of Sciences in many parts of the world, but he also supplemented such findings by field investigations of his own wherever necessary or possible. Among the scientists who, under the auspices of the French Academy, made many valuable astronomical place determinations in various parts of the world, and by whose work Delisle especially benefited, may be mentioned: the astronomer Chazell who, beginning in 1693, made extensive field measurements along the Mediterranean shores and finally established for the first time the true longitudinal spread of that sea; J. D. Cassini and his son Jacques who made similar determinations in Flanders, Holland, and England, in 1697; and especially Louis Feuillée who made many valuable place determinations from 1701 to 1724 in the Near East, Central and South America, and the Canary Islands. The correct geographical bearings thus gathered for a number of vital points on the face of the globe were most expertly utilized by Delisle.

It was on Delisle's famous world map[7] of the year 1700 that all these multiple place-data were first combined in scientific synthesis. On this map there was also shown for the first time the true east-to-west extent of the Mediterranean Sea--forty-two degrees--as against sixty-two degrees assigned to this sea by Ptolemy. The map was reissued in 1724, but with additions and corrections. As might be expected, most of Delisle's later and more localized maps, and especially his maps of France, show rather higher degrees of scientific accuracy than it was possible for him to attain in his early world map.

On the whole, the Delisle maps may be said to set new standards of scientific correctness, but they also display technical defects of workmanship that are best characterized as crude. The maps, in general, excel in their completeness of place indications, their correctness in place-names, and their delineations

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[7]Cf. Phillips, op. cit., title 533.

of rivers and of political boundaries. A grid is practically always shown on the maps, though the scale is indicated by linear measure only. Needless to say, fantastic or purely pictorial effects are entirely absent from these maps. The real weakness of the maps, as of all other maps of the period, is their crude and wholly unrealistic representation of relief. It is true, however, that reliable altitude measurements as well as the more general determinations of the slope of the earth surface had to wait for quite a number of years on further progress in mathematical physics supported by the development of new and appropriate instruments. But the Delisle maps definitely mark the beginning of scientific mapping; they are among the outstanding contributions of the eighteenth century.

It was in the maps of Delisle's successor, Jean Baptiste Bourguignon d'Anville (1697-1782), that scientific accuracy and sober excellence of workmanship found a most happy blending. D'Anville's first maps began to appear in 1730. It was not long afterwards that the superior qualities of his maps gained for him universal acclaim as the foremost cartographer of the age. It is true that d'Anville's work benefited greatly by the fact that an official topographical bureau was established in France during this time. Among the numerous fine map works that were produced by d'Anville mention may be made of his Nouvel atlas de la Chine; de la Tartarine chinoise which appeared in 1735. The maps included in this atlas show all the Chinese provinces: Tibet, Mongolia, and Manchuria. They were in fact veritable masterpieces that excelled all previous attempts of this nature.[8] The atlas remained the standard work on China for many years. Other notable maps are the map of Asia of 1751-53, the large map of Africa of 1749, the map of Canada, Louisiane, et les terres anglaises of 1755, and the Atlas antiquus of 1768.[9] D'Anville produced, in all, about 212 maps;[10] they form the body of his Atlas général which appeared in 1780.

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[8]A. Stavenhagen, "Skizze der Entwicklung und des Standes des Kartenwesens des ausserdeutschen Europe," Petermanns Mitteilungen; Ergänzungsheft, No. 148 (1904), p. 131; this work is still valuable and has not yet been superseded.

[9]Cf. Phillips, op. cit., title 3268.

[10]Herbert George Fordham, Studies in Carto-Bibliography, British and French, and in the Bibliography of Itineraries and Road-Books (Oxford: The Clarendon Press, 1914), p. 165.

The d'Anville maps show almost perfect outlines of the land masses. They represent a truly scientific cartography, though relief on the maps is still shown by the old perspective method. The influence of the maps was considerable and lasting. The maps were often reproduced not only in France but also in England and on the Continent.

On the whole, it may be said of the general maps of the eighteenth century that they delineate fairly correctly the geometric outlines of the earth's surface but fail seriously in the representation of its vertical configurations. On these maps, as on the maps of the previous period, conventional symbols resembling molehills or caterpillars are still the usual devices employed for the portrayal of relief. The earliest attempt to vary the intensity of shading according to the degree of slope appeared upon a map in Johann Baptist Homann's atlas, prepared in 1718. But it was not until 1783 that a method of representing relief by contour lines and hachures was scientifically worked out by J. G. Lehmann.[14] The first large map to incorporate contour lines was the map of France produced in 1791 by the French geographer Dupain Triel (1722-1805). Thereafter, the contour and hachure method of showing relief was generally used in topographical mapping. Further progress and refinement in exact cartographical representation had to await the achievements of the following century.

## The First National Topographic Map: The Cassini Map of France[15]

Beginning about the middle of the eighteenth century the cartography of France increasingly assumed the aspects of large scale mapping under government auspices. Here again it was France

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[14]Robert Eric Dickinson and O. J. R. Howarth, The Making of Geography (Oxford: The Clarendon Press, 1933), p. 118.

[15]On the history of this great map consult the following sources: Henri M. A. Berthaut, La carte de France 1750-1898 (2 vols.; Paris: Imprimerie du Service géographique, 1898-99); idem, Les ingénieurs géographes militaires, 1624-1831; étude historique (2 vols.; Paris: Service géographique de l'armée, 1902); also the article by L. Gallois, loc. cit., with its valuable bibliographical references; also Stavenhagen, op. cit.; and the section, entitled "The Cassini Family and the Triangulation and Mapping of France," which covers pp. 39-56 of Fordham's Notable Surveyors, op. cit.

that led the way and gave to the world the first example of the complete topographical survey of a whole country. The map resulting from this survey is known as the Cassini map of France; it was compiled and published during the years 1750-1815.

It is noteworthy that four successive generations of the Cassini family played a leading role in the origination of the map of France.[16] The first two Cassinis, Jean Dominique Cassini (1625-1712), and his son Jacques (1677-1756), laid the astronomical foundations of the map, and their two successors, César François Cassini, Comte de Thury (1714-1784), and his son Jean Dominique (1748-1845), had charge of the actual cartographical construction and publication of the map. The map itself is based directly on the early place measurements made by the French Academy of Sciences between 1666 and 1684, and extended and completed from 1733 to 1756. The great map of the region surrounding Paris, based upon the work of the French Academy of Sciences and engraved by F. de la Pointe in 1678, may be considered the prototype of the Cassini map. The map consists of nine sheets and is laid out exactly on the same scale as the Cassini map, namely, 1:86,400.[17]

July 7, 1747 is a crucial date in the genesis of the Cassini map. On that date César François Cassini laid before Louis XV of France certain maps and plans illustrating military operations then in progress in Flanders. These plans so aroused the king's enthusiasm that he gave orders to have the whole of his kingdom covered with similar maps. Thereafter, for many years, the energies of César François Cassini and of his son, Jean Dominique, were devoted to the arduous task of carrying out the king's instructions. Many vicissitudes intervened before all the map-plates were finally completed in 1793. The last map-sheets did not make their appearance until 1815. The advent of the Seven Years' War necessitated the withdrawal of governmental aid from the map and resulted in its sponsorship being taken over, for a time, by the French Academy. For this reason the Cassini map has also become known as the Carte générale de la France, dite de l'Académie.

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[16]The personal history of the Cassini family is treated in Charles Wolf's Histoire de l'Observatoire de Paris de sa fondation à 1793 (Paris, 1902).

[17]Lucien Gallois, loc. cit., p. 201.

After the outbreak of the French Revolution and the reign of the Directorate in 1793, the map was finally taken over by the War Ministry and intrusted by it to the permanent care of the reorganized Dépôt de la Guerre. The systematic mapping of France and the periodic revision of its official maps were made the major objectives of this bureau. Since about the time of the French Revolution, topographical surveying and mapping in France have been practically the exclusive concern of the engineer-geographers of the Dépôt de la Guerre. It should be noted that the name of this bureau was superseded in 1888 by the present title of Service Géographique de l'Armée.

The Cassini map consists of 160 full sheets and twenty-four quarter sheets printed in black and white. It is drawn on the scale of 1:86,400 and is projected on a modified conical projection. A grid of geographical coordinates is absent on the map, and distances are shown in "toises"[18] from great circles running at right angles east and west, and north and south, through the Paris Observatory. All the usual topographical details, such as roads, rivers and canals, towns, villages, and forests, are represented. Valleys are indicated by hill-shading of a uniform character. But the effect of this shading is so unrealistic as to give the impression that the whole country is a level plain of low elevation cut by equally shallow and uniform valleys throughout. This very inadequate representation of general surface configuration is the most striking defect of the Cassini map.

A map in black and white showing the extensive network of triangles which was spread over France in connection with the Cassini map was issued by César François Cassini in 1744.[19] The map shows no less than nineteen base lines and some forty thousand triangles of various orders. Coordinates of the principal towns and their distances from Paris are indicated in the margin of the map-sheets. A description of the map and of its underlying data was published by Cassini in the year 1783 under the title of Description géométrique de la France.

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[18] A "toise" is equal to six French feet, which is a little less than six feet five inches English measure.

[19] See especially Lucien Gallois, loc. cit., pp. 303-05.

## Maps Derived from, or Inspired by the Cassini Map[20]

The influence exerted by the Cassini map was admittedly very great, both directly and indirectly. Indirectly it inspired the making of accurate maps in other parts of Europe; directly it was amplified and corrected by various maps based upon or in extension of it. One of the latter is the beautiful Carte chorographique des Pays-Bas Autrichien prepared by the Comte Joseph de Ferraris in 1777-78 for the Austrian government. The map is on the same scale as the Cassini map. It remained the authoritative map of Belgium until about 1830. In England the Cassini map was very literally followed by John Cary in his road-book of 1784, and in some of his other maps.

Almost simultaneously with the production of the Cassini map of France a need arose for a map on a more convenient scale. The Cassini map was too bulky for many purposes both civil and military. Furthermore, the defects of the map, particularly the representation of roads and of slope, made themselves more and more felt. The publication by Louis Capitaine, in 1789-90, of a one-fourth reduction of the Cassini map was, therefore, a most welcome advent. This map was adopted by the French government and intrusted by it to the Dépôt de la Guerre in 1815. The map is superior to the Cassini map because it shows three different kinds of roads as against one kind of road indicated on the Cassini map. Relief is also shown on the map far more realistically than on any other map that has been discussed thus far. Darker shading along the southwest slope of the mountains makes them stand out quite boldly. But it is still impossible to know the relative heights of the mountains for no figures are supplied. This map remained the principal medium-scale map of France until 1840, when it was replaced by a similar map on the scale of 1:320,000, which was compiled from more recent data.

## Nineteenth Century Topographical Mapping in France: The Carte de l'Etat-Major[21]

The defects inherent in the Cassini map of France were so keenly felt by Napoleon that he commissioned the Chevalier Bonne

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[20]See Stavenhagen, op. cit., pp. 139-40; also Fordham, Notable Surveyors, pp. 62-67.

[21]On this map see Berthaut, op. cit.; also Stavenhagen, op. cit., pp. 147-74.

in 1808 to devise plans for the construction of a new map of France. Actual work in preparation for the new map did not commence, however, until 1818, and the huge task of laying a newer and more extensive network of triangles over France was not completed until 1854. This work of triangulation was also supplemented by many new astronomical place determinations and by trigonometric levelling. First order triangulation, this time, consisted of chains of quadrilaterals running along meridians and parallels, so as to form a grid. This triangulation as well as the construction of the map was performed by the engineer-geographers of the Dépôt de la Guerre. The first sheets of this map, known as the Carte de l'Etat-Major, were issued in 1832, and the final sheets in 1878. The map may be said to mark the culmination of French cartographic production in the nineteenth century.

The map consists of 274 quarter-sheets printed in black and white and drawn to the scale of 1:80,000. Relief is indicated by hachures. A grid of geographical coordinates is incorporated. The map is vastly superior to the Cassini map, though it is not yet all that such a map should be topographically, for it is still primarily a military map. The map is also not very suitable for geological survey mapping.

The absence of contour lines on the map is, of course, one of its major weaknesses, though there is some compensation because of the presence of a number of spot heights. But the accurate contouring of topographic maps depends primarily on the character and correctness of a series of local levels that have been precisely determined on the basis of mean sea level as the zero point of elevation. It is by precision or geodetic levelling that foundation lines are provided for all the local levels. Such elaborate levelling was not, however, considered a practical problem at the time the map was being planned, and heights were determined by the less exacting trigonometric method. It is true, of course, that trigonometrical heights are quite good enough for a topographical map of a new country, but where the demand for more accurate and more detailed knowledge of the relative heights of a country is desired, the survey cannot be considered complete until lines of levels have been run all over the lower and more accessible and developable parts of the country.[22]

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[22]Hinks, op. cit., p. 202.

Indeed, it was not until 1861-64 that there was spread for the first time in any country a systematic and coherent network of precise levelling.[23] Again France assumed leadership in this new development and the scientist, Bourdaloue, executed the work at the behest of the French government. The levelling was done over a stretch of fifteen thousand kilometers and resulted in the determination of the level lines of some ten thousand places, spaced on the average about 7/10 kilometer apart. Bourdaloue also fixed upon the mean sea level along the coast of Marseilles as the zero point of elevation for the levelling of the whole of France. A rechecking of all the levels was undertaken almost immediately and, beginning in 1870, work was started on a new, improved, and far more extensive net of levels, covering all of France. The map of France, by way of revision, benefited, of course, directly by the results of the new precision levelling.

## Revision of the Carte de l'Etat-Major: Derivative Maps

A first revision of the entire map was completed in 1883 and a second one in 1902. Revision of this map is still being carried on, for the map must continue to serve as the official topographical map of France until the new map of France on the scale of 1:50,000, now in progress, will be completed.

The Carte de l'Etat-Major has naturally been the source of numerous other maps on smaller scales.[24] Among these the two following maps are especially noteworthy: the map of France published in 1852-86 on the scale of 1:320,000, in thirty-three sheets, printed in black and white, with relief indicated in hachures (this map is now kept up to date with respect to railroad lines only); the other map, on the scale of 1:200,000, printed in colors, and provided with contour lines spaced forty meters apart. This latter map was first published in 1880-95, and has since been kept up to date along with the corresponding sheets of the mother map. The map is complete in eighty-five sheets.

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[23]Stavenhagen, op. cit., p. 155.

[24]Stavenhagen, op. cit., pp. 164-68.

## The Latest Topographic Mapping of France: The Map on the 1:50,000 Scale

The new topographical map of France on the scale of 1:50,000, which has been in process of publication since the beginning of the century, is the direct outcome of new and more comprehensive and accurate field surveys made in France since 1870.[25] These surveys included a new measurement of the central meridian of France, and also a careful check-up of the main triangulation network. Steps were also taken to extend this network southward to Spain and Algeria and northward to Great Britain and Shetland. A map showing the progress that has been made up to the present time in this triangulation of France is available from the Service Géographique de l'Armée. It is significant that the accuracy of this work is greatly enhanced by the lay-out of a new and vastly enlarged and improved net of precision levelling which was started in 1883. It is expected that this new net of precise levels will eventually lead to the exact determination of the vertical surface configuration of the whole of France.

It is also noteworthy that these new and accurate field measurements are making it possible for the first time to compile a quite serviceable cadastral map of France. In fact the publication of such a map has been in progress since 1897. The map-sheets are in black and white and are on the scale of 1:10,000, except for the mountain regions for which the scale of 1:20,000 is used. The maps are provided with contour lines.

However, the real goal of these new and elaborate field surveys is the consummation of the topographical map of France on the scale of 1:50,000. The early sheets of this map have been in process of publication since 1900; but only the eastern sections of France and the region about Paris have been covered thus far. Many more years will no doubt have to pass before this new map of France will be complete. It may be recalled that the first sheets of this map, designated as "Type 1900," were issued in from eight to ten colors. This costly color-scheme was discontinued in 1922 and was then superseded by map-sheets making use of only five colors. These latter sheets are known as "Type 1922." Relief is shown on the map by contour lines and by a double system of hill-shading. Spot heights are also frequently indicated. Latitude

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[25] Ibid., pp. 174-80.

and longitude are shown in the ordinary and the centesimal divisions. Detailed key-index charts are available.

### Map Catalogs Published by the Service Géographique de l'Armée

Two different map catalogs are issued by the Service Géographique de l'Armée at Paris. One of these lists historical and other maps no longer valid, such as the Cassini map of France, and the military campaign maps of 1914-18, and the other lists the maps that are now in force, or the cartes en service. The full title of the latter map-list is as follows: Catalogue des cartes, plans et autres ouvrages publiés par le Service Géographique de l'Armée. This catalog is issued periodically and is kept up to date by an annual supplement issued each January. The catalogs, maps, and supplement, as well as complete sets of key-index charts, may be obtained directly from the Office of the Service Géographique de l'Armée, 136 bis Rue de Grenelle, Paris, or from authorized agents.

The catalog of current maps also lists the map publications of the Service Géographique du Maroc, and of the Bureau Topographique de l'Armée Française du Levant. This latter bureau publishes, however, a map catalog of its own which is rather more comprehensive than the aforementioned list.

For the map and chart publications of West Africa there is available an excellent catalog, entitled Inventaire méthodique des cartes et croquis, imprimés et manuscrits, relatifs à l'Afrique Occidentale, existant au gouvernement général de l'A.O.F., à Dakar. The work extends over some 139 pages, inclusive of index and a list of the principal publications relating to the geography of West Africa. It was compiled by Commander Ed. de Martonne, and was issued in 1926 from the press of Goupil, at Laval. A supplement with index charts was issued in 1935. It is entitled Catalogue des cartes et publications du Service géographique de l'Afrique Occidentale Française. It is obtainable from the office of the Service géographique de l'Armée, at Paris. It may be noted that the Inventaire does for the map publications of West Africa, what the great Catalogue of Maps of Hispanic-America . . . ., issued by the American Geographical Society, does for maps of Central and South America.

## CHAPTER VI

## MODERN BRITISH CARTOGRAPHY BEFORE THE ESTABLISHMENT OF THE ORDNANCE SURVEY[1]

It must not be believed, however, that the British Isles had no share in early modern cartographic production. Perhaps the earliest known engraved map of Great Britain is the one published by Pietro Coppo in 1525 and discovered recently by Professor Roberto Almagia in the Municipal Library at Pirano, Istria. A map of England and Wales with parts of Scotland and Ireland is the first printed map of the British Isles; it was prepared by Sebastian Münster and included in his edition of Ptolemy, dated 1540. But the avowedly "most important document in the cartography of the British Isles during the sixteenth century," is the map of Great Britain attributed to the Englishman George Lily, and produced by him at Rome in 1546. Another noteworthy map of the British Isles is the one issued by Mercator in 1564. But during all these early years there originated in Great Britain neither an atlas nor a county map, and though the first map of England by Humphrey Lhuyd (1527-68), of Denbighshire was completed by 1568, it was not published until 1573 when it appeared in the first supplement to the Theatrum of Ortelius. It is well to call

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[1]Invaluable for this period is the scholarly bibliography by Thomas Chubb, entitled The Printed Maps of the Atlases of Great Britain and Ireland. A Bibliography, 1579-1870. With an Introduction by F. P. Sprent, and Biographical Notes on the Map Makers, Engravers and Publishers (London, 1927); see also the following two works by Miss Eva G. R. Taylor, Tudor Geography, 1485-1583 (London, 1930); and Late Tudor and Early Stuart Geography, 1583-1650 (London, 1934). The first of these two volumes is based on the bibliography of all English geographical writings in manuscript or print which the author has been able to trace. A chronological list of these is added in an appendix. The second volume is a sequel to the first. Some two thousand geographical items are listed. Their range is extensive--from drainage plans to reports of earthquakes, from atlases and travel collections to pamphlets on trade. Part of the bibliography of this volume is supplementary to that of the earlier one. Maps and plans are listed separately in the index. A third volume of the series is promised for the future.

attention to these rather halting beginnings of British cartography, for they were soon to be followed by a remarkable burst of activity.

## The Real Founders of British Cartography: Saxton and Speed

There were various reasons why England was at that time well groomed for a striking development in cartography. The great Elizabethan period was for England not only the golden age of literature and drama, but also of exploration and adventure. Keen interest was naturally felt in all the freshly revealed wonders of the New World, and the national temper was such that there was a general desire to learn more about the homeland also. It is therefore not surprising to find that the cartographers and geographers, in their humbler and less spectacular manner, were as active as the seamen and poets.

The great landmarks of English topographic and cartographic progress in the half century after 1570, are identified with two of the most famous of English atlases, namely those of Saxton and Speed. From these early and, in some ways, brilliant beginnings the course of British cartography may be readily traced down to the Bartholomew and the Ordnance Survey maps of the present day.[2]

In the long list of British makers and compilers of maps and atlases the first name is also one of the greatest; it is that of Christopher Saxton who flourished from 1570 to 1596. The great work particularly associated with his name is an atlas--now one of the most desirable possessions to which the collector of English maps can aspire--which represents the results of some nine years of arduous labor spent in surveying and drawing maps of each county in England and Wales. It is noteworthy that the thirty-four plates from which the county maps were printed remained in use for over a century and a half and were probably not effectively displaced until the appearance of John Cary's new county map in eighty-one sheets, in 1794. Saxton is also credited with a large general map of England and Wales, in twenty sheets, measuring about 5 1/2 by 4 1/2 feet, and on the scale of between 7 1/2 and 8 miles to the inch. Saxton deserves credit not only for his

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[2]See especially the clear and lively sketch of this development in Mr. F. P. Sprent's introduction to Chubb's list of British maps, vide supra; see also Fordham, Notable Surveyors, pp. 1-22.

work of a pioneer but also because his maps are most attractive in themselves. The county maps were first issued in atlas form in 1579 and were nearly all engraved by artists of the Low Countries.

Saxton was soon followed by other map-makers. John Norden (1548-1626) and Philip Symonsen both produced British maps before 1600, and made an important contribution by their inclusion of roads. The former had the ambitious design of compiling a whole series of county histories, to be accompanied in each case by a map; but he actually succeeded only in publishing descriptions and maps of Middlesex (1593) and of Hertfordshire (1598).[3]

The real successor to Saxton was John Speed (1555?-1629) whose Theater of the Empire of Great Britain was published in 1611. It is an atlas--now very rare--that must be ranked as one of the greatest of English productions of this nature. Its maps are largely based, however, on the maps of Saxton and Norden, and were beautifully engraved by the Dutch engraver Jodocus Hondius.[4] The work of Speed was to some extent that of a popularizer. He made his maps more attractive by adding small inset views of plans of county towns adorned with the coat of arms of famous noblemen. There are also notes on the map dealing with battles and with the general history of the country. Speed's success in making his work popular is shown by the fact that some fourteen reprints either of the Theater or of the maps in atlas form without text are known to have been issued before the end of the eighteenth century.

### Important Maps of Great Britain Produced in Foreign Countries

The Low Countries are responsible for the production of two early important atlases of Great Britain. In 1645 the Blaeu establishment at Amsterdam devoted the entire fourth volume of its Atlas Novum to the cartography of England and Wales.[5] The maps in this volume are beautifully executed, but they are derived

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[3]Herbert George Fordham, Studies in Carto-Bibliography (Oxford, 1914), p. 5.

[4]Chubb, op. cit., p. 453.

[5]Ibid., p. xiii.

almost entirely from the maps of Speed, to whom acknowledgment is made in the preface. A few years later Blaeu added a fifth volume to his Atlas Novum, which was, in fact, the earliest atlas of the Scottish provinces, districts, and counties.[6] These Scottish maps were chiefly based on the surveys of Timothy Pont, as corrected and completed by Robert Gordon of Straloch. Maps of parts of Ireland had already appeared in Speed's atlas, but of Scotland only a general map had been given. Some maps of northern and southern Scotland had also been included in the Dutch atlas published by Hondius in 1633. Finally in 1646 the firm of Jansson of Amsterdam--a rival to the Blaeu firm--included in the fourth volume of its big atlas a number of maps of Great Britain that were very similar in content and workmanship to the Blaeu maps of the previous year.

## Further Progress in British Cartography: The Contributions of Ogilby and Petty

Before the end of the seventeenth century there appeared two more names that are important in the history of British cartography, namely those of John Ogilby (1600-76) and of Sir William Petty. Ogilby is of special importance because his work may be said to mark the first big advance in British cartography since the time of Saxton. To him was intrusted, as the "King's Cosmographer," the big task of surveying the roads of England and Wales. This great undertaking was accomplished probably between the years 1670 and 1675 and the results were published in the latter year in the form of an imposing volume entitled: Britannia, Volume the First: or, an Illustration of the Kingdom of England and Dominion of Wales. . . . . The work includes some hundred plates of road maps and about two hundred pages of explanatory text. The plates do not show the whole country, for they are in the form of strip-maps. It was from this source that the later road-books derived their larger share of information. Ogilby compiled various other maps and atlases, including an important plan of London; but his name is chiefly associated with the road-maps.[7]

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[6]See Harry G. R. Inglis, et al., The Early Maps of Scotland, with an Account of the Ordnance Survey, (Edinburgh: Royal Geographical Society, 1934).

[7]Fordham, op. cit., pp. 23-60; these pages correspond to the chapter, entitled "British Itineraries and Road-Books," and include a description of Ogilby's map productions.

Sir William Petty's fame rests primarily upon the completion of his survey of Ireland. The maps based on this survey were published in atlas form in 1683, under the title of: Hiberniae Delineatio. This work holds a place of honor in the annals of Irish cartography similar to that occupied in Scottish cartography by the Blaeu volume containing the maps of Timothy Pont. No other names of outstanding importance are to be recorded for the remainder of this century, though mention may be made of the sea charts of John Seller (d. 1700) whose English Pilot appeared in 1671, and of Greenville Collins who published his Great Britain's Coasting Pilot in 1693.

## British Cartography in the Eighteenth and Early Nineteenth Centuries

With the eighteenth century British cartography enters a period in which new contributions are few, though this century looms large from the standpoint of bibliography, for the makers of British maps and atlases were many. We may note among them:[8] John Senex, John Rocque, the Bowens, Thomas Kitchin, Thomas Jefferys, John Ellis, Daniel Paterson, the Armstrongs, and the family of Bowles who published maps throughout the century. A typical atlas of the period is the large English Atlas with maps by Emanuel Bowen, Kitchin, and others, which was published in several editions between 1750 and 1790. The general standard of atlases of this period was not high; no doubt one was freely copied from another, and too little effort was made to bring their information up to date.

But even before the end of the century developments were taking shape which were to cause a great advance in British cartography. One of these was the offer of premiums and bounties made by the Society of Arts (founded in 1754) for large-scale maps. The result was that between 1750 and 1809 maps on the scale of one or two inches to the mile were produced for all except thirteen of the fifty-two counties of England and Wales.

Meanwhile another map-maker of great importance made his appearance on the British scene in the person of John Cary (1754-

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[8] On these map-makers, see the excellent biographical notes in Chubb's list of British maps, op. cit.; the Dictionary of National Biography may also be helpful.

1835.[9] Cary started out as a map-engraver but set up, in 1784, as a publisher on his own account. Thereafter, for some forty years, Cary published a large number of atlases, geographical and geological maps, road maps, road books and itineraries, town plans, terrestrial and celestial globes, etc. The influence of the great work of Cassini is very evident in Cary's method of map delineation and of surface representation.

The earliest Cary atlas is that of the year 1787; it is a quarto atlas of the English counties and is entitled New and Correct English Atlas. Eight re-issues are known up to 1831, followed by several editions from the same plates by G. F. Cruchley. A large folio general atlas was issued by Cary in 1808 as the New Universal Atlas, and a large folio New English Atlas, containing a set of county maps was published between 1809 and 1834. It is quite probable that Cary drew the designs of his county maps, as well as the outline of his first large general map of England and Wales (1794), from the materials supplied by the large-scale county maps surveyed and engraved for different publishers during the latter half of the eighteenth century. This work, though wanting in uniformity and, in many cases, in accuracy involved a distinct advance on anything in the nature of original cartography that had been undertaken in England since the survey of Christopher Saxton.

Of Cary's general maps, that of England and Wales and part of Scotland, in eighty-one sheets, on the scale of five miles to the inch, issued in 1794, is perhaps the most important. An Improved Map of England and Wales, with a considerable portion of Scotland, in sixty-five sheets, was issued in 1832. This map benefited, no doubt, directly by what had then appeared of the Ordnance Survey one-inch map.[10]

Cary has been credited altogether with some 550 individual maps, contained in atlases. The figure of 1,000 has been set by way of a low estimate of his total output of maps, books, and other publications. In his influence on British cartography Cary may be said to rank with Saxton and Ogilby. His maps are usually

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[9]See Herbert George Fordham, John Cary, Engraver, Map, Chart and Print-Seller and Globe-Maker, 1754 to 1835. A bibliography, with an introduction and biographical notes (Cambridge, 1925).

[10]Fordham, Notable Surveyors, p. 74.

marked by an excellence of workmanship and a standard of accuracy far in advance of what prevailed in England before his time. Cary probably deserves the high praise bestowed on him by Sir Herbert George Fordham who names him the founder of the modern English school of cartography.

The Beginnings of Official Mapping in Great Britain

At a time when France had almost completed its national topographic mapping and was approaching the British government with the proposal that the observatories of Paris and of Greenwich be connected geodetically, Great Britain had not even started on the task of laying out a systematic network of triangulation. It is true that repeated attempts had been made to have the British Isles mapped systematically and to have a national survey department established for this purpose, but the advent of the Seven Years' War and the war with America prevented positive action.

The person most notably identified with the movement to lift British cartography from its rather unscientific status to that of an exact science placed under the centralized control of the national government, is General William Roy (1726-1790). Roy had already made a name for himself with his fine survey work in the Scottish Highlands during the Rebellion of 1745. The acceptance by the British government of the French proposal to connect the Paris and Greenwich observatories geodetically finally gave Roy the long sought opportunity to execute what was in fact the first systematic triangulation in Great Britain. Roy commenced his great task in 1784 by measuring out a base line at Hounslow Heath, in the south of England and, in September 1787, formal triangulation was begun in cooperation with the French. In the words of Sir Charles Close, "this was the first accurate triangulation carried out in the British Isles and set a remarkably high standard; it provided for the first time, a thoroughly reliable framework for map-making, and it led directly to the formal founding of the Ordnance Survey."[11]

It was not until after Roy's death, however, that the Survey was officially established. Details respecting the nature and

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[11]Quoted in Fordham's Notable Surveyors, p. 82; in pp. 76-85, of this same booklet, Fordham gives a brief sketch of the role played by Roy in the establishment of the Ordnance Survey.

scope of the Ordnance Survey have been included in the chapter devoted to the official maps and map sources of Great Britain.

There is not much to add to the subject of British Cartography after the nineteenth century and the period of John Cary and of the Ordnance Survey. We may note, however, important developments in layer coloring and the marking of contours with which the name of Bartholomew is particularly associated. Mention may also be made of the Arrowsmiths who produced some good work in the early part of the century, and of the fine county maps of the Greenwoods, which appeared chiefly between 1820 and 1830; the work of the Keith Johnstons of Edinburgh, in the middle of the nineteenth century, is also noteworthy. With the higher standard of accuracy of the more modern maps there necessarily came an increase in uniformity, so that while the maps of the nineteenth century gained in reliability, they lost in variety and in picturesqueness of detail.

## CHAPTER VII

## THE MAPPING OF THE NORTH AMERICAN CONTINENT IN THE SIXTEENTH CENTURY

The generality of the maps produced soon after the time of Columbus show an ocean between eastern Asia and western Europe filled with a number of large and small islands. Some of these are the old islands mentioned by Marco Polo and others are the new ones added by Columbus and his companions. The magnitude of the South American continent to which exploring expeditions were first directed was recognized earliest. Consequently, South America was separated on the maps from Asia and designated as Novus Mundus or New World. After 1533, that is, subsequent to the conquests and voyages of Magellan, Pizarro, and their contemporaries, this concept of South America as a separate continent became the generally accepted one. Similarly early and rapid was the exploration of the interior of that country. Thus, in 1535, Ayolas ascended the Parana and the Paraguay as far as twenty degrees south latitude and then crossed the plains to Peru; in 1540 Francisco Orellana embarked upon one of the upper tributaries of the Amazon and followed that mighty river across the continent to the sea; two years later, Cabeza de Vaca explored a route from the southeastern coast of Brazil to the town of Asuncion in Paraguay; in 1557 the daring navigator Juan de Ladrillero proceeded from the Chilean frontier to the Strait of Magellan and through the main channel to the Atlantic Ocean, and in 1560-61 Lope de Aguirre sailed down the Amazon to the vicinity of the Orinoco tributaries and thence by the latter to the Orinoco and the Atlantic.[1] The lure of the fabulous, induced by the extraordinary treasures of Mexico and Peru, was no doubt the most important reason for these rapid explorations. The South American continent ceased therefore at an early date to be a major problem of mystification to the geographer and cartographer. But it was quite otherwise with the

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[1] J. Fred Rippy, Historical Evolution of Hispanic America (New York, 1933), p. 56.

vast continent stretching out to the north, for it became known only gradually and region by region. We may thus confine this rapid sketch of the early maps of the New World to those relating to the North American continent.

Soon after the return of Columbus to Spain the lands newly discovered, and still to be discovered, were divided between the two Hispanic powers, Spain and Portugal. The division was effected by Papal Bulls (1493) and the Treaty of Tordesillas (1494). The line of demarcation separating Spanish from Portuguese possessions in the New World corresponded approximately to the meridian passing through Halifax.[2] This line gave to Spain absolute sovereignty over the territory situated west of longitude 63°, and to Portugal no North American coast line south of latitude 44° 30'. Portuguese pilots were therefore not permitted to explore and map any part of the coast now corresponding to the eastern boundary of the United States. It gave, however, to Portugal a clear title to the territories located east of the line of demarcation, that is, to the Isle of Cape Breton, to Newfoundland, to the eastern shore of Labrador, and to the major portion of Nova Scotia. But if Spain played the leading role in the exploration of the American seacoast, it is by no means true that she exerted a corresponding influence in the early cartography of the New World. Indeed it is to Portugal that credit is due for having been first to conceive and to portray the new continent (excepting, of course, the polar regions) with its correct and proper contour. It is known that Spanish American cartography began immediately after the voyage of Columbus, but we have no knowledge of any important Spanish map dating back to the first quarter of the sixteenth century, and none has survived. With the exception of the Juan de la Cosa map, the first charts of America had their origin in Portugal.

The running of the Atlantic coast line of what is now the United States was the achievement of four Spanish voyages: those of Ponce de Léon, of Francisco Gordillo, of Lucas Vazquez de Ayllon, and especially of Estevan Gomez. The examination of the coast line bordering the Gulf of Mexico was the combined work of Ponce de Léon (1513), of Hernandez de Cordoba (1517), and of Alonso de Pineda, whose special map of Mexico was laid down in

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[2]Henry Harrisse, Découverte et évolution cartographiques de Terre Neuve ... (London and Paris, 1900), p. lv.

1519.[3] In the north, along the coasts of Nova Scotia, Newfoundland, Labrador, and Greenland, landfalls were first made (excepting the Norse voyages of the tenth to thirteenth century) by English, Portuguese, and French vessels.

Along the western confines of North America, north of Panama, coastal explorations were chiefly the work of the Spaniards: Vasco Nunez de Balboa; Hurtado de Mendoza; Francis Vazquez de Coronado; Francisco de Ulloa, and Juan Rodriguez Cabrillo and his chief pilot Ferrelo.[4] The Pacific coast was first sighted by Balboa in 1513. In 1540, Hernando de Alarcon sailed up the Colorado by way of the Gulf of California and, two years later, Juan de Cabrillo struck across the outer side of the California peninsula and coasted north to just beyond San Francisco Bay. The ascent north along the coast was continued in 1543 when Ferrelo reached latitude 42° or 43°, or approximately the southern tip of what is now the coast line of Oregon. The earliest map showing the coasts about the entrance of the Gulf of California dates from 1535, and is by Hernando Cortes. However, the more famous early map of the region is the Castillo map of 1541. Castillo accompanied Alarcon in 1540 as one of his pilots. The next important Spanish exploration of the California coast was not made until just after the turn of the century, when Sebastian Vizcaino surveyed the Pacific coast of North America from Cape Lucas to Cape Mendocino in 1602. He prepared reports and a map, notarial copies of which were made in Mexico in 1603. A reduced copy of the map in thirty-six sheets was published by don M. F. de Navarrete in his atlas and introduction to the voyage of the schooners Sutil and Mexicana, issued in Madrid, in 1802.[5] It is noteworthy that these earliest maps of the California region correctly depicted Lower California as a peninsula, while later maps persisted in representing it as an island.

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[3]See Woodbury Lowery, A Descriptive List of Maps of the Spanish Possessions within the Present Limits of the United States, 1502-1820. Edited with notes by Philip Lee Phillips (Washington: Government Printing Office, 1912), title 15; under this title may be found valuable notes and references to the map.

[4]The best account of these voyages is that of Henry R. Wagner, Spanish Voyages to the Northwest Coast of America in the Sixteenth Century (San Francisco, 1929); the work is accompanied by map reproductions.

[5]See Lowery, op. cit., title 95.

The first important major excursion into the interior of the American continent north of Mexico was undertaken by Hernando de Soto in 1539. De Soto set out from the west coast of Florida and during four relentless years roamed over some 350,000 square miles of unknown country bounded approximately by latitudes 28° and 36°, and longitudes 82° and 100°.[6] The Mississippi River was sighted by De Soto in 1541 at a point somewhere south of where now is the city of Memphis. Quite in consonnance with the belief of the age that inland America contained a large sea with navigable rivers flowing from it to the Pacific and Atlantic coasts, De Soto may well have believed that he had at last discovered the long sought "strait" leading to the Pacific. But neither Estevan Gomez' surveys up the Atlantic coast, nor Ferrelo's ascent on the Pacific side, or De Soto's costly march inland brought realization to Spain's hopes for the discovery of that elusive water-connection which geographers felt must exist between the Atlantic and Pacific. Indeed, the results of these coastal and inland explora tions were so profoundly disillusioning that from the date of the return of De Soto's expedition in 1543 until 1769 Spain practically confined herself to re-exploring and filling-in of gaps left on the maps between lines of earlier discoveries. There still were to appear individual adventurers who, undaunted by the disillusions of past explorations, pushed on further inland to the same disappointment of their predecessors. Among these may be noted Tristan de Luna y Arrelano who made his way to the Alabama River and westward toward the Mississippi in 1559-60; Juan Pardo, who explored the eastern slope of the Blue Ridge Mountains in 1566, and his lieutenant Boyano, who crossed the mountains to the Alabama in the next year; and Antonio Gutierrez de Humana who rode from Quivira to the Platte River in 1594.[7]

The turn of the century brought finally the novel note of European competition in North America. The "golden age" of Spain had then definitely passed its zenith, and its rapidly failing power could no longer hold back the growing strength of France, England, and the Dutch Netherlands who, with scant respect for the Papal bulls of demarcation boldly defied Spain's monopolistic

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[6]For a recent discussion of the route followed by De Soto, see Theodore Maynard, De Soto and the Conquistadores (New York, 1930); bibl., pp. 279-87.

[7]John Bartlet Brebner, The Explorers of North America, 1492-1806 (New York, 1933), p. 101.

pretentions on the continent. And it was in connection with the exploratory and colonizing ventures of these countries, and especially of the French, that large sections of the interior of the North American continent were for the first time mapped with a real approach to accuracy. This modern period in American cartography commences with the systematic explorations, from the St. Lawrence Gulf and River, of the great French explorer and geographer, Samuel Champlain, in 1603. It closes the first or "early" age of discovery and rapid preliminary exploration commencing with the first voyage of John Cabot in 1497.

## The John Cabot Voyages to North America[8]

Credit for the discovery of the North American continent (not counting the earlier Norse voyages) belongs to England. It was under letters patent of King Henry VII of England that John Cabot (Giovanni Caboto), a Genoese like Columbus, sailed west from Bristol in 1497 in search of a northwest passage to India, and also "to discover and investigate whatsoever islands . . . . which before this time were unknown to all Christians." Cabot, and possibly his famous son Sebastian, subsequently, made a landfall at Cape Breton, followed the south coast of Newfoundland to Placenta Bay and, after sighting the Avalon Peninsula, he returned to England.[9] He was certain of having reached the northeastern projection of Asia. Hoping to gain a swift approach to Marco Polo's Cipangu (Japan) by extending his course further south and west, Cabot set out on a second voyage in 1498. The location of his landfall has remained unknown; but it was probably made on Newfoundland. He next sailed down the American coast to near Florida and then returned to England. Good evidence is available, moreover, to support the belief that his son Sebastian led a similar expedition in search of a northwest passage in or about 1508,

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[8]See James Alexander Williamson, Voyages of the Cabots and the English Discovery of North America under Henry VII and Henry VIII (London: Argonaut Press, 1929). This is the standard monograph on these voyages. The work is admirably documented and illustrated. Its frontispiece is a superb reduced copy of Jomard's reproduction of the Cosa map.

[9]William Francis Ganong, "Crucial Maps in the Early Cartography and Place-Nomenclature of the Atlantic Coast of Canada," Transactions of the Royal Society of Canada, 3d series, Vol. XXVII (1933), sec. ii, p. 150.

and reached Hudson Bay and Strait, after which he sailed down the Atlantic coast to near the West Indies and thence returned to England. Nothing was made by England of these epochal voyages. Their real objective--the discovery of a northwest passage to Cathay--having failed, England's interest in North America lapsed until the last quarter of the century when Sir Humphrey Gilbert began his spirited agitation for renewed English attempts to discover such a passage.

## The Juan de la Cosa Map of 1500

The earliest known map to show any part of the North American continent and to indicate some of the results of the Cabot voyages, is the Juan de la Cosa manuscript world map of the year 1500. Cosa accompanied Columbus on his first voyage as master of his flagship, and on the second voyage (1493-96) as his official cartographer. The American features of the map are therefore largely based on Cosa's own observations. Date and authorship of the map are attested by the following original inscription: "Juan de la Cosa la fizo en el Puerto de S. M$^{a}$ en ano de 1500." The map was discovered in 1832 in a Paris curio shop, and is now preserved in the Marine Museum at Madrid. It may be noted that its early date as well as its originality have recently been treated monographically and have been seriously questioned.[10]

Of the numerous reproductions that have been made of this famous map only five have been copied directly from the original, and one of these has been declared" so crude and erroneous as to be useless for any critical purpose."[11] The first and earliest reproduction is a partly colored lithograph made for Baron von Humboldt's Examen critique de l'histoire de la géographie du nouveau continent, Vol. III (Paris, 1837); the second is a full-size lithograph and is included in Ramon de Sagra's atlas to his Historia fisica de Cuba (Paris, 1837); and the third is the black and white, full-size lithograph made for Jomard's great atlas,[12]

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[10]George E. Nunn, The Mappemonde of Juan de la Cosa; a Critical Investigation of its Date (Jenkintown, 1934).

[11]Ganong, op. cit., XXIII (1929), sec. ii, p. 141.

[12]Edmé François Jomard, Les monuments de la géographie ... (Paris, 1842-62). See Phillips, List of Geographical Atlases, op. cit., title 251, for an analysis of the contents of this work.

which copy has naturally formed the basis for many subsequent reproductions; the fourth is the full-size lithograph copy published by Vallejo and Traynor at Madrid in 1892; it is apparently the least valuable of the five; the fifth and last is a photogravure of a recent untouched photograph made directly from the North American portion of the original map; it is included in Isaac Stokes' Iconography.[13]

The original La Cosa map measures about 5 1/2 x 3 feet; it is ornately colored; but without coordinates or scale. It is clearly a compiled map. The source of what appears to be a delineation of the south coast of Newfoundland and Cape Breton was no doubt the original Cabot map recording the latter's explorations of 1497-98.[14] What gives the map special value is its presentation of the West Indies at the moment of their discovery. It shows the first lands explored and depicts the islands of the Antilles and the American continent from the river Amazon to the Isthmus of Panama. What is most surprising, however, is that the map delineates Cuba as an island, for this fact was not officially ascertained until 1508 when Sebastian de Ocampo made the first circumnavigation of the isle. It is just possible, of course, that Cosa obtained previous knowledge of this fact through contact with the natives. But this point has given rise to considerable controversy.

Like all the early maps this map does little more than indicate general direction and cannot be used for measurements like a modern map based on scientific surveys. The map is oriented by a great wind-rose south of the east and west coast line, by the equinoctial line and the Tropic of Cancer, and by the meridian line through the Azores. In reading the map one must take into account not only the projection and the magnetic variation but also the impossibility of ascertaining longitude. There are also very sizable errors of latitude. Thus Cuba and Hispaniola are drawn entirely north of the Tropic of Cancer, whereas they are entirely south of it. Pictorially the map is filled with kings and queens and towered cities, in the manner of the age. It is

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[13]Isaac Newton Phelps Stokes, Iconography of Manhattan Island (6 vols.; New York: R. H. Dodd, 1915-28), II, Plate I.

[14]For a searching analysis of the Cosa topography and nomenclature as related to the Cabot voyages, see Ganong, op. cit., XXIII (1929), sec. ii, pp. 140-75.

full of legendary and biblical lore--"Three Kings of the East," the "Queen of Sheba," the "Great Khan of Tartary," together with men whose heads are set flat down on their shoulders, and many other traditional monsters. Though this map is of a distinctly superior type, its influence on contemporary or subsequent cartographical work is difficult to trace.

## Some Early Maps Based on Portuguese Voyages

Next in point of time to the Cosa map is the manuscript planisphere world map named after Albertino Cantino, the envoy of the Duke of Ferrare to the court of Portugal. The map was produced at Lisbon about 1502. It is now in the Estense library at Modena, Italy. An excellent photo-lithograph made directly from the original is included in the Stevenson series of map reproductions.[15] The map shows the approximate outlines of a northwestern continental region corresponding to the east coast of North America from Florida to about the Delaware or Hudson River. There is no doubt that the cartographer considered the Asiatic world as separate from the newly discovered countries.[16]

The more recently discovered manuscript world map by Nicolay de Carnerio,[17] is undated though approximately of the same date as the Cantino map. It also exhibits the northwestern continental region, but carries it further south, adds more names and hedges the entire coast between Spanish flags. Here, too, the continental land is clearly separated from the Asiatic world by a well defined western coast.

Both of these maps give prominence to lands supposed to have been visited by the Cortereal brothers in 1500-01-02, under

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[15]Edward Luther Stevenson, Maps Illustrating Early Discovery and Exploration in America, 1502-30 (New Brunswick, N.J., 1903); see Phillips, List of Geographical Atlases, op. cit., title 1139, where a table of contents of the work is given.

[16]Henry Harrisse, Discovery of North America (London and Paris, 1892), p. 111.

[17]See Edward Luther Stevenson, Marine World Chart of Nicolo de Canerio Januensis 1502 (circa) (New York: American Geographical Society and Hispanic Society of America, 1908). A facsimile of the map, in ten large folio sheets with key map, is published separately.

letters patent of King Emmanuel of Portugal.[18] The avowed object of these voyages was to discover a western route to Asia via the polar seas. Actually, the results were limited to exploration and mapping of parts of Greenland, Labrador, and Newfoundland. The maps also give evidence of knowledge drawn from other coast charts and from written reports. But whatever these sources may have been, the maps certainly record discoveries along the Atlantic coast actually made and reported before the Spaniards, Ponce de Léon and Estevan Gomez, turned their prows in that direction. It was, moreover, this early Portuguese type of map which, finding its way into Germany, became the basis of that most important series of New World maps of which the famous Waldseemüller map is the most conspicuous example.[19]

The most significant early American map compiled chiefly from Portuguese sources is the famous Martin Waldseemüller world map, in twelve sheets, dating from the year 1507. It is the first map on which the name of America appears inscribed upon the outline of what is now South America. The New World is represented by a narrow island separated from Asia by a considerable extent of ocean. The map was first discovered by Father Joseph Fischer in 1900, at the Wolfegg Castle, Germany. The chief sources from which Waldseemüller drew in the construction of his map were: the Ptolemy maps of the Ulm edition of 1486; the Tabulae modernae of this same edition; the Etzlaub traveler map (1501); Marco Polo's travels and, most of all, as regards the delineations of the New World, the Portuguese Carnerio map.[20]

The Waldseemüller map is one of a whole series of maps pronouncedly Portuguese in inspiration, which are characterized by their delineation of the newly discovered lands in the west as distinct from Asia. It was on the maps of this nature that America became geographically fixed for the first time. The type was a prevailing one for many years, particularly in Germany.

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[18]See H. P. Biggar, "Voyages of the Cabots and Cortereals to North America and Greenland, 1497-1503," Revue Hispanique, X (1903), 485-93.

[19]See the chapter, entitled "Lusitano-Germanic Cartography," in Harrisse, Discovery, op. cit., pp. 289-362.

[20]Josef Fischer und Franz R. von Wieser, Die aelteste Karte mit dem Namen Amerika aus dem Jahre 1507 und die Carta Marina aus dem Jahre 1516 des M. Waldseemüller (Innsbruck, 1903).

Prominent among these maps were the New World maps first appearing in the Strassburg edition of Ptolemy of 1513, and in many editions thereafter; the maps of Glarenus; Stobnicza; Apianus; Gemma Frisius; Sebastian Münster, and Honterus. Of the globe and gore maps which reproduced the type there is likewise a considerable number, of which the Hauslab, the Nordenskiöld, the Tross, and the Schöner gores are conspicuous examples.[21]

Another famous early map inspired in part by the Portuguese voyages is the Ruysch world map which first appeared in the Ptolemy edition of the year 1508. On this map the northern extremity of the American hemisphere is represented with a continuous coast line running from Greenland to Labrador and thence due west until it merges, at its western extremity, with the Far East, or Cathay. Ruysch evidently believed that a certain portion of the New World was identical with the east coast of Asia, and that the North Atlantic and the North Pacific oceans were identical. But it is also true that south of this region Ruysch depicts a wide ocean bordering on large and distinctive continental lands far away from China and Japan. Ruysch therefore believed that the countries north of Nova Scotia were Asiatic, while the continental regions to the south, representing the discoveries of Columbus and of the Spaniards, formed one or two continents entirely distinct from Asia.[22] This great map served, moreover, as an inspiration to many later maps and so helped to perpetuate the misconception about a partly Asiatic identity of the New World which neither Balboa's discovery of the Pacific (1513), nor Magellan's epochal voyage (1519-22), could arrest effectively. It finally gave way, however, and the map which Myritius included in his Opusculum geographicum rarum, in 1590, displays the last visible example of this kind of confusion.

But there were also cartographers, indeed there was a whole school of them, who considered the New World as a mere prolongation of Asia. But with the exception of the rough pen-sketches attributed to Bartolomeo Columbus and recently discovered

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[21]Edward Luther Stevenson, "Typical Early Maps of the New World," Bulletin of the Geographical Society of America, XXXIX (1907), 216.

[22]Harrisse, op. cit., p. 113.

by Professor Wieser,[23] it is not until the appearance in 1526 of Franciscus Monachus' De orbis situ that we come upon the first interesting reversion to this notion, admittedly held by Columbus. Thereafter, for many years the idea seemed to come and go as fact or fancy dictated. It found an interesting modification in the Gastali map of 1548 and in the Homem map of 1561, in which both an Asiatic and a European connection are indicated.[24] It was finally disposed of in 1728 and 1741 when the Dane Vitus Bering established the insularity of the New World by sailing up the Strait which bears his name.

A similar illusion was the "Strait of Anian,"[25] which was commonly thought to mark the end of the northwest passage leading to the Pacific Ocean and was accepted by geographers as the strait in the north corresponding to the one discovered by Magellan to the south of South America. It apparently was shown for the first time upon the Zaltieri map of 1566, entitled Discoperto della Nova Franza.[26] Thereafter this invention persisted to figure upon maps for almost two hundred years. The problem was not finally disposed of even by Cook's third voyage and investigation in 1778. In 1793 Alexander Mackenzie crossed from the St. Lawrence River to the Pacific ocean, but the crossing was primarily by land. The northwest passage by sea was at last successfully negotiated in 1903-05 by the polar explorer Ralph Amundsen.

## Early Spanish Voyages and Maps

The Cabot-Cortereal-Fagundes discoveries around Newfoundland and Cape Breton, in the north, had their counterpart in the early Spanish explorations of the North Atlantic coast further south. The first authorized expedition to Florida was made by Ponce de Léon in 1513. Though his landings cannot be ascertained, it is known that his discovery embraced the extreme southeast of

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[23]Franz von Wieser, Die Karte des Bartolomeo Colombo über die Vierte Reise des Admirals (Innsbruck, 1893).

[24]Stevenson, op. cit., p. 217.

[25]See George E. Nunn, Origin of the Strait of Anian Concept (Philadelphia: Privately printed, 1929).

[26]Henry R. Wagner, "Apocryphal Voyages to the Northwest Coast of America," Proceedings of the American Antiquarian Society, XLI (1931), 182.

Florida and extended westward perhaps to 30° north latitude and 70° west longitude.[27] In 1519 Alonso de Pineda skirted the whole coast of the Gulf of Mexico from the southern tip of Florida to the Panuco River. The voyage definitely established the fact that there was no open route to Asia from this section of the Atlantic. The Spaniards next turned their attention to the eastern coast of Florida, and in their efforts to find a passage there examined the country as far north as Chesapeake Bay, which was reached about 1526.

The oldest Spanish maps of importance which have come down to us belong to the third decade of the sixteenth century. One of the earliest and most significant of these showing the outlines of Florida is the Turin-Spanish planisphere, unsigned and undated, but dating from about 1523. It is entirely of Spanish origin and is preserved in the Royal Library at Turin. A reproduction of it is included in the Stevenson series of early maps. The coast delineations commence in the north, with Florida, which is shown as separate from the mainland. The east coast begins with the delta of the Mississippi, and continues uninterruptedly to the Strait of Magellan. The seaboard then ascends on the Pacific side about six degrees. The map represents one of the most valuable sixteenth century documents with respect to nomenclature, for it has many names which are not inscribed on any previous map and were certainly taken from ancient and authentic sources.

In general, the early maps portraying a New World topography all show the Cabot-Cortereal-Fagundes coast lines and nomenclature in the Newfoundland-Cape Breton region, Spanish topography and nomenclature in the Florida and Gulf of Mexico areas, and either an ocean or an obviously conventional coast line as an intermediary connection between these two extremes. This holds true of all the general maps up to the year 1525. Then, rather suddenly, this great gap became filled in by the definite and detailed topography and nomenclature made available through the Jean de Verrazano voyage in 1524, and the Estevan Gomez voyage in 1525.

### The Verrazano and Gomes Voyages and Maps

Giovanni da Verrazano, a Florentine by birth, was sent in 1524 by the King of France to search for a passage to the East

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[27]Harrisse, op. cit., p. 149.

Indies and China by way of America. Verrazano apparently made a landfall in North Carolina and closely examined the coast all the way to Cape Cod.[28] Unfortunately, his original report with accompanying map has been lost; but Italian reports summarizing the outstanding features of the voyage have survived, and so have the fine maps of Maggiolo (1527), and of the navigator's brother, H. de Verrazano (1529), which agree so closely with the reports as to leave little doubt about their being based on Verrazano's own lost map.

The world map constructed upon the Verrazano data by the eminent Italian cartographer Visconte de Maggiolo is a beautifully colored manuscript planisphere, preserved in Milan, Italy.[29] The American portions of the map have been reproduced in the Stevenson series, and a similar reproduction, directly from the original, is included in Stokes' Iconography. The map is noteworthy for its rather detailed representation of the eastern coast of North America and for its peculiar contour of the west or Pacific coast. To the northward of the Florida region there is a northeast extension of coast, then a break, then the coast of "bacalnaos" and, lastly, the coast of "Lavoradore." In the west the Pacific coast extends northward from the Central American region in a wide sweeping curve almost parallel with the coast line of the Gulf of Mexico, and merges with the Atlantic coast not far from the vicinity of Cape Hatteras. This is also the first known map to note Balboa's discovery of the Pacific (1513), which it does by means of an inscription. The Münster map of 1540,[30] the Agnese world maps,[31] and the Lok map of 1582, are later representatives of this type.

The Hieronimus de Verrazano map of 1529 is a well-drawn world map preserved in the Propaganda Museum at Rome. An adequate reproduction of it is included in the Stevenson series, and a fine photo-copy taken directly from the original is shown in Stokes'

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[28]Ganong, op. cit., Vol. XXVII (1933), sec. ii, p. 151.

[29]On this map, see the articles by Professor Ganong, and also the bibliographical notes and references in Lowery, op. cit., title 25.

[30]See Lowery, op. cit., title 29.

[31]On the Agnese maps and atlases, see the excellent monographic study by Henry R. Wagner, "The Manuscript Atlases of Battista Agnese," Papers of the Bibliographical Society of America, XXV (1931), 1-110.

Iconography. A detailed analysis of the topography and nomenclature of the map has been contributed by Professor Ganong.[32] In his judgment, the Maggiollo map is the better of the two maps because it "conforms much more nearly to reality than does the Verrazano map with its erroneous latitudes, its overemphasized easterly trend, over-accentuated topography in the New York region, and its more conventionalized style of drawing."[33] This is also the first Italian map on which the name of "America" is inscribed. An able summary of other maps based on Verrazano data has been prepared by Professor F. C. Wieder for Stokes' Iconography.[34]

But if Verrazano's voyage added much to the knowledge of the Atlantic shores, it also produced one of the most extraordinary "mare's nests" in the history of cartography. Thus, on the two maps just noted, North America is shown as a double continent, joined by a narrow isthmus along the Virginia coast, with the entire central portion of what is now the United States represented as a vast Mediterranean Sea. And this imaginary "Sea of Verrazano" --a misconception of Chesapeake Bay--continued to confuse the minds of European explorers and map-makers for a hundred years, and its presence upon contemporary maps helps to explain the otherwise puzzling persistency with which every bay and river, however, insignificant, was examined as a possible channel into this elusive sea.

Strangely enough, this voyage under French auspices was practically duplicated in the next year by Estevan Gomez, who was sent by Charles V of Spain to seek, like Verrazano, a northwest passage to Cathay. Gomez made a landfall north of Cape Cod and explored the coasts of New England and New Brunswick. Skirting southwestward along the coast of Nova Scotia, he recrossed to the mainland and proceeded back to Cape Cod and to Nantucket Island. He then sailed southwest, not sighting the coast again until near Cape Hatteras, after which he returned to Spain via the West Indies.[35] Though this voyage was a year later than that of Verrazano, it achieved earlier and wider cartographical recognition. None of the original reports and maps of the Gomez voyage have

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[32] Op. cit., Vol. XXV (1931), sec. ii, pp. 174 ff.; see also Lowery, op. cit., title 30.

[33] Ganong, Ibid., p. 190.

[34] Stokes, op. cit., ii, 13-17.

[35] Ganong, op. cit., Vol. XXVI (1932), sec. ii, pp. 127 ff.

survived; but their substance was promptly incorporated in the great standard official maps produced by Spain's most eminent cartographers, such as Diego Ribero,[36] Alonso de Chaves,[37] and Alonso de Santa Cruz.[38] And it was these maps which became the foundations of all the composite maps of the remainder of the century.

Maps Based Directly on the Gomez Voyage

These maps fall into three principal groups, conveniently designated as the Ribero group; the Chaves-Santa Cruz group; and the Gastaldi-Italian group.[39] Of the Ribero group we note the "Castiglioni" or Mantua map of 1525; the Weimar Spanish maps of 1527 and 1529; and the Rome Ribero map of 1529. The Castiglioni map is the earliest known world map based on the Gomez Voyage. It is an anonymous manuscript map, although the evidence points to Diego Ribero as its maker. It served perhaps as a base map for the official "standard map," or padron real, which Ribero was instructed to draw up in 1526. A photo-facsimile of it was first published, with commentary, by M. Bellio in the Raccolta Columbiana, Part IV, Vol. II (1893).

The Weimar Spanish maps of 1527 and 1529 are manuscript world maps preserved at Weimar, Germany. The first of these is unsigned but is believed to be by Ribero, the second bears his name. Both maps have been photo-lithographed and exhaustively monographed by John G. Kohl.[40] They are also reproduced in the Stevenson series. The maps seem to be distinct elaborations of the same basal padron real--Ribero's. The later one of the two maps is, however, markedly more detailed than the earlier one. It is, in fact, definitely superior to any other map produced up to that time. But in spite of individual differences of detail and quality, these four maps form a closely related group. They all have the same striking feature of a very rapidly eastward trending Atlantic coast line in the north, and all are apparently based on the same padron real--the one prepared by Ribero in 1526.

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[36]See Lowery, op. cit., title 31.

[37]Ibid., title 35. [38]Ibid., title 39.

[39]See Lowery, op. cit., title 31.

[40]John G. Kohl, Die beiden aeltesten General-Karten von Amerika (Weimar, 1860).

The next, or Chaves-Santa Cruz group of maps is based on the new padron real produced by Ribero's successor, Alonso de Chaves. These maps are essentially of the same nature as the Ribero maps, though there are important differences of detail. This padron real has not survived, but the Chaves manuscript dating from 1537 which was recently discovered by Professor Wieser gives a fair idea of this lost map.[41] The small manuscript world map produced by Santa Cruz after the completion of his Islario in 1541, is preserved at the Royal Library at Stockholm. An attractive photo-facsimile of it was published in 1892 by E. W. Dahlgren of Stockholm, under the title of Map of the World by the Spanish Cosmographer Alonzo de Santa Cruz, 1542.

A comparison of the Ribero group with the Chaves-Santa Cruz group reveals the latter as the more accurate and detailed of the two. A notable feature of both is complete lack of any trace of the Verrazano voyage and cartography.

There are also a number of maps which, although based directly on the Gomez voyage and following in the main either the Ribero or the Chaves-Santa Cruz groups, contain certain features not held in common with them. Of these may be mentioned: the "Wolfenbüttel-Spanish map" of circa 1529; the "Salviati" manuscript world map of 1525-26; the Agnese map of 1530; the Vaz Dourado map of after 1540, and the Lopo Homen map of 1554. The Wolfenbüttel-Spanish map portrays only the western half of the world, that is, the Americas, the Molucca Islands with a small portion of the mainland. The map is anonymous and undated, but closely related to the Ribero group, as pointed out by Stevenson.[42] An interesting feature of the map is its explanation of the origin of the name of Labrador, which it does by the following legend: "the land of Labrador was discovered by the English from the city of Bristol, and as he who first sighted it was a farmer from the Azores Islands, this name remains attached to that country." The "Salviati" manuscript world map is preserved in the Laurentian Library at Florence. It is unsigned and undated, and named after

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[41]Franz R. von Wieser, Die Karten von Amerika in dem Islario General (1541) des Alonzo de Santa Cruz (Innsbruck, 1908).

[42]The map is described and analyzed by Edward Luther Stevenson, "Early Spanish Cartography of the New World," Proceedings of the American Antiquarian Society, XIX (1909), 369-78; with a facsimile reproduction of the Wolfenbüttel map.

the family whose arms it bears. It is evidently based on a primitive form of the Ribero group. A full-size photo-reproduction is included in the Stevenson series of early maps. The Agnese map of circa 1530, a reproduction of which appears in the Kunstmann Atlas,[43] is anonymous, but is so entirely in the style of the Italian Agnese as to leave no doubt of its origin. Although only a crude sketch, the map is related to the Ribero group, and especially to the "Weimar-Spanish" type of this group. The Vaz Dourado map of after 1540, which also is reproduced in the Kunstmann Atlas, seems to be the earliest of several fine maps by that Portuguese cartographer. In topography and nomenclature it is closely related to the Chaves-Santa Cruz group, though Portuguese sources were also drawn upon. Finally, the Lopo Homem map of 1554 is perhaps closer than any other known map to the lost Chaves chart. A good photo-reproduction of its American portion appears in Stokes' Iconography.

Another distinct group of maps based on Gomez data is the so-called Gastaldi-Italian group of maps. Of these may be noted: the Gastaldi[44] world map included in the Ptolemy edition of 1548; the Bertelli map of about 1565, a photo-facsimile of which appears in Nordenskiöld's Periplus; the Zaltieri map of 1566 in the Italian Lafreri Atlas, which is also reproduced in the Periplus; and the "Remarkable" Italian map of 1562-67, a reproduction of which appears in Muller's Remarkable Maps,[45] and in Caraci's Tabulae.[46]

Maps Based on the Cartier Voyages

Although the first three decades of the sixteenth century saw the North Atlantic coast explored and roughly mapped from Florida to Labrador, it was not until the advent of the Cartier voyages of 1534-35 and 1541, that the Gulf and River of St.

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[43]Friederich Kunstmann, Atlas zur Entdeckungsgeschichte Amerikas (Munich, 1858).

[44]On Gastaldi and his map publications, see especially the articles by Bagrow, op. cit.

[45]Frederick Muller & Co., Remarkable Maps of the XV, XVI, & XVIIIth Centuries reproduced in their Original Size . . . . (Amsterdam, 1894-97).

[46]Guiseppe Caraci, Tabulae geographicae vetustiones in Italia adservatae (3 vols.; Florence, 1926-32); reproductions of manuscript and rare printed maps.

Lawrence were discovered and recognized as geographical and cartographical entities.[47] These voyages were made in behalf of the King of France who had commissioned Cartier to "explore and take possession of New France, and to find by the North the passage to Cathay . . . . , to discover certain islands and countries where it is said that a great store of gold should be found." Neither a passage nor gold were found. Instead, Cartier made the epochal discovery of the fertile lowlands of the St. Lawrence on which, some decades later, France was to establish a vast overseas dominion.

There is no doubt that Cartier made detailed maps and records of his three voyages, though not a single original document of his has come down to us. All we possess is a number of short contemporary summaries of his records, and some maps compiled directly from Cartier's own.[48] These maps fall into two groups: a French group attributed to the Dieppe school of cartographers; and a Portuguese-Cartier group based on an unknown Portuguese original which was itself directly compiled from Cartier material. This Portuguese map was most likely the work of the eminent Portuguese cartographer Lopo Homem,[49] who produced it, perhaps, in 1534.

The rise of the first prominent type of French world maps dates from the Cartier voyages.[50] They were the work of cartographers located in or near the city of Dieppe, France, best known of whom are the names of Nicolas Desliens, and of Pierre Desceliers. The maps of this school were chiefly based on Spanish originals, though Portuguese sources were also drawn upon. Perhaps

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[47]A seemingly complete "Cartier Bibliography," by titles, has been published by Lucien Brault in the Bulletin des recherches historiques, December, 1935, pp. 724-35. On the Cartier voyages and cartography, see especially Professor Ganong's articles in the Transactions of the Royal Society of Canada, Section II, for 1934 and 1935, respectively; and Henry Percival Biggar's Voyages of Jacques Cartier (["Publication of the Public Archives of Canada," No. II] Ottawa, 1926), which is an indispensable work.

[48]On the Cartier maps, see especially Ganong, op. cit., XXVIII-XXIX (1934-35), sec. ii.

[49]The authorative work on Portuguese cartography is Professor Armando Cortesao's Cartografia e cartografos portuguesos dos seculos XV e XVI (2 vols.; Lisbon, 1935).

[50]On the French or Dieppe school of cartographers, see the chapters in Henry Harrisse's Discovery, op. cit.

the most important Portuguese source map was the Lopo Homem map of circa 1534, better known as the "Riccardiana," because of its inclusion in an atlas preserved in the Riccardiana Library at Florence. This great map filled a role in Portuguese cartography similar to that occupied in Spanish cartography by the padron real. A fine photo-reproduction of the "Riccardiana" appears in Harrisse' Découverte ..., Plate VI.

The most important maps of the two groups are briefly noted as follows: The earliest of these, the French Jean Rotz map of circa 1535, is the only known map showing Cartier's first voyage alone. The map is preserved in the British museum. A fine full-size lithograph of the American portion appears in the Kretschmer atlas;[51] and a photo-reproduction of the St. Lawrence region of the map is included in Biggar's Voyages, Plate V.

The well-known "Harleian" map of circa 1536 is a beautiful French manuscript world map, undated and unsigned, though generally attributed to Desceliers. It is the first map to show the St. Lawrence River. Its nomenclature includes the names of "Canada" and "Sagne" (Saguenay). The large "continental" area northeast of Florida is delineated with the peculiar shape characteristic of the Dieppe school. The map is a typical compiled map based respectively on the contrasting Ribero and Chaves types. An excellent full-size photo-facsimile of this and two other Desceliers maps has been made available in Lord Crawford's Bibliotheca Lindesiana.[52]

The Desliens map of 1541 has special interest because it is the earliest known dated map to show Cartier's second as well as his first voyage. It is also the first dated product of the Dieppe school of cartographers. It is a manuscript world map which curiously enough has the simple portolano form instead of the elaborate decorative character of most of the maps of the period. The map is preserved in the Royal Library at Dresden. A photo-reproduction of it has been made available by Hantzsch

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[51]Konrad Kretschmer, Die Entdeckung Amerikas ... Text and Atlas (Berlin, 1892); see Phillips, op. cit., title 1136, for a table of contents of the atlas.

[52]James L. Lindsay Crawford, Biblioteca Lindesiana. Collations and Notes No. 4. Autotype facsimiles of three mappemondes . . . . With an introduction including a short notice on Desceliers' later mappemonde . . . . by Charles Henry Coote . . . . (Aberdeen, 1898). Pp. 18; atlas. Cf. Phillips, op. cit., title 248.

and Schmidt.[53] Closely related to the Desliens map is the "Morgan map" of circa 1542, now in the possession of the Pierpont Morgan Library, New York City. It is a French manuscript world map. A photostat copy of it is in the Library of Congress. A brief description of it has been given by Professor Ganong.[54]

The Sebastian Cabot map[55] of 1544 is a famous Spanish world map, dated and ascribed to Cabot. The only known copy of this map is preserved in the Bibliothèque Nationale, at Paris. It is the earliest engraved map showing Cartier's explorations of the Gulf and River of St. Lawrence. There is some doubt about the authorship of the map; but it is believed that Cabot was responsible for its general content and lay-out as well as its legends, while the actual preparation was left to a compiler. It is an excellently drawn and engraved map. The Atlantic coast appears delineated to the northerly point reached by John Cabot in 1498, namely. the entrance to Davis Strait and the Strait of Belle Isle, though the west coast extends only to the point reached by Domingo del Castillo in 1541. It seems, moreover, that the map which Castillo made of the California regions was incorporated in Cabot's own map. A full-size reproduction of it appears in Jomard's Monuments. One of the map's numerous inscriptions reveals that Newfoundland was discovered by John Cabot and his son Sebastian on June 24, 1497. In geographical design the map much resembles the Desliens map of 1541.

The Pierre Desceliers map of 1546 is closely related to the Cartier narratives and the"Harleian" map, though with differences of detail. It is a well-known and beautiful manuscript world map preserved in the John Rylands Library at Manchester, England. The Desceliers map of 1550 is another elaborate manuscript world map. It is signed and dated, and represents Desceliers' best work.[56] It is an improvement on the earlier map which it much resembles.

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[53]Viktor Hantzsch und Ludwig Schmidt, Kartographische Denkmäler zur Entdeckungsgeschichte von Amerika, Asien, Australien und Africa ... (Leipzig, 1903); cf. Phillips, op. cit., title 250.

[54]Ganong, op. cit., XXVII (1933), sec. ii, p. 187.

[55]For bibliographical notes and references, see Lowery, op. cit., title 44; also George Parker Winship, Cabot Bibliography . . . . (New York, 1900).

[56]On Desceliers' work, see Albert Anthiaume, Pierre Desceliers, Père de l'hydrographie et de la cartographie françaises (Paris, 1926).

The Nicolas Vallard map of 1547 forms part of a manuscript World Atlas now in the Huntington Library, at San Marino, California. A full-color reproduction of it was published in the Illustrated London News of August 11, 1934. A detailed discussion of it appears in Kohl's Discovery of Maine.[57] The best parts of the map are the waters and coasts north of Maine and the outlines of the Gulf and River of St. Lawrence. Nearly all the names from the Strait of Belle Isle along the south coast of Labrador, and along the northern shore of the River St. Lawrence, appear to be copied from Cartier's reports and charts. The waters and coasts near New York seem to be wholly omitted, so that this part of the map exemplifies one of the manifold misrepresentations of the Estevan Gomez exploration, introduced first in the map of Ribero, and thereafter repeated in endless variations. South of the Bay of Sta. Marie (Chesapeake Bay), as far down as Florida, the map shows the customary nomenclature which originated with the expeditions of Ponce de Léon and Ayllon. Distinguishing features of the map are the excellently drawn pictures of natives and explorers, one of whom may be Cartier.

The Portuguese Diego Homem map of 1558 is significant not only because of its Cartier topography, but also because of its relatively correct delineation of the coast line of Nova Scotia and New England, and its first showing of the Bay of Fundy. The map forms part of a beautiful atlas in the possession of the British Museum. A reproduction of the Homem map of 1568, which is almost a duplicate of this earlier map, appears in Hantzsch and Schmidt's Kartographische Denkmäler.

The "Carte Portuguaise du Dépot," of circa 1550, is believed to realize more closely than any other known map the topography and nomenclature described in the Cartier narratives. The map is undated and unsigned, and preserved by the Service Hydrographique de la Marine, at Paris. It is perhaps the most important member of the Portuguese-Cartier group. A reproduction of the St. Lawrence region of the map is included in Harrisse's Découverte, Plate XVI.

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[57] Johann Georg Kohl, A History of the Discovery of Maine ([Maine Historical Society: "Documentary History of the State of Maine," Vol. I] Portland, 1869); see also the bibliographical notes and references, in Lowery, op. cit., title 45.

The great Mercator map[58] of 1569 is by far the most famous compiled map of the sixteenth century. It is a sea chart of the world and represents, as stated in an inscription, "a new and enlarged delineation of the land of the globe, perfectly adapted to the use of pilots." Apart from the novelty of its epochal projection ever since associated with the name of Mercator, the map presents a number of distinguishing geographical features. It excels especially in its delineation of the results of the Cartier voyages. The principal affluents of the St. Lawrence, the Saguenay, the St. Maurice, the St. John, and the Ottawa are all indicated in nearly their true outline. To the west of the Ottawa River, in about latitude 60°, appears a part of a large lake covered with a latin inscription alluding to the presence there of a fresh water lake--possibly Lake Superior or Lake Huron. The map was also, perhaps, first in delineating the Alleghany mountains with approximately their true distance from the Atlantic coast. The southern section of this mountain chain, it may be recalled, was discovered by De Soto on his grand expedition to the Mississippi River during 1539-43, and the latter's reports of this and other inland discoveries were fully made use of by Mercator. A most valuable feature of the map is its fairly correct delineation of the large peninsula of Labrador, for it had been inaccurately outlined on all previous maps, including the well-known "Riccardiana" or Homem map of 1558.

As might be expected, the map shows most satisfactorily that part of the world best known at the time, namely, Europe. The American continent, as a whole, is not so well delineated. For example, the Bay of Fundy, the coasts of New England, the region about New York are either not shown at all or else very badly. Moreover, the map's outline of the entire United States coast corresponds so closely to what is shown in this respect on the French world map of 1550, reproduced by Jomard under the title of Mappemonde peinte sur parchemin par ordre de Henri II, Roi de France, that Mercator must have had a copy of this map before him when he drew this section of the coast.[59]

The nomenclature along this coast is also much corrupted and sometimes scarcely intelligible. Some of it is of Portuguese

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[58]For bibliographical notes and references to this map, consult Lowery, op. cit., title 55.

[59]Kohl, op. cit., p. 390.

derivation and much more dates back to the map of Ribero and the Gomez voyage. It is indeed a remarkable fact that the icy seas and coasts of Greenland, Labrador, Newfoundland, and Canada were depicted on sixteenth century maps with a high degree of accuracy, while the coasts of New England and the New York region were badly drawn almost to the end of the century. When modern French and English explorers arrived on these coasts at the beginning of the century following, they had to begin the work of exploration anew.

Unlike other maps by Mercator, this world map is not reproduced in his great atlas. Three single copies of the map have come down to us; they are preserved in the following institutions: the Bibliothèque Nationale, Paris; the City Library, Breslau, Germany; and the University Library, Basel, Switzerland. A full-size reproduction may be found in Jomard's Monuments, and a half-size facsimile reproduction of the North American portion of the Breslau copy is included in Paullin's atlas.[60]

The map's influence on American cartography was considerable. Reproductions of it were freely made by Mercator's successors--Ortelius (1570); Wytfliet (1597); Hondius and others. They would sometimes change or add something to the original; but they would all respect Mercator's "Rio Grande of Norumbega," that is, the Penobscot with its two branches, east and west; and the fabulous city of "Norumbega," on its banks, partly borrowed from earlier Spanish maps, and partly drawn from more personal sources. Even such maps as those of John Dee (1580) and Hakluyt (1589) of England, reproduced these features.

The later maps of the century, with one or two exceptions, present no real cartographical advance over the maps already noted. Nevertheless these later maps include many of great interest in themselves, partly for their beauty of execution, and partly for other reasons. It is only towards the close of the century that some maps show traces of new knowledge, derived no doubt from the reports of the ever more numerous private voyagers to the New World. Among these, the Lemoyne map of 1591 is particularly

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[60]Charles Oscar Paullin, Atlas of the Historical Geography of the United States. . . . . Edited by John Kirkland Wright ([Published jointly by the Carnegie Institution of Washington, and by the American Geographical Society] Washington, D.C. and New York, 1932). A full-size reproduction, in eighteen sheets, of the Breslau copy of the map, was published in 1931 by the International Hydrographic Bureau, at Monaco.

worthy of mention, for it is the first map depicting with considerable detail a large portion of Florida and Georgia. It also served as a source for many later maps. Its maker, Jacques Lemoyne, was a member of René Laudonnière's expedition to Florida in 1564, and as such was commissioned to prepare "an accurate description and map of the country, and make drawings of all curious objects." However, the more immediate purpose of the expedition was to find a refuge in the New World for Laudonnière's Huguenot compatriots who were oppressed in France. Both the resulting map and the reports of the expedition were acquired in 1587 by Theodore de Bry and published by him as Brevis narratio eorum quae in Florida Americae provincia Gallis acciderunt (Frankfurt-on-Main, 1591). A reproduction of the map has been made available by the Hakluyt Society.[61]

Just at the end of the century appeared a remarkable world map, also known as the "New Map of Shakespeare," because it is supposed to be the "new map with the augmentation of the Indies," mentioned in Twelfth Night, Act III, scene ii. It is an engraved map without date or title, and is believed due either to Emerie Molineaux, or to Edward Wright, or to both. It is the first world map on the Wright-Mercator projection engraved in England. The west coast of North America is shown as far north as New Albion, which was visited by Drake (1578); the northern discoveries of Frobisher (1576-78), and of John Davis (1585) are also indicated. The map was perhaps first published in 1599 in loose form, and was next included in Richard Hakluyt's Principal Navigations (London, 1600). It is a graduated map, measuring approximately 25 x 17 inches. A reproduction has been published by the Hakluyt Society.[62] A slightly reduced facsimile of the North American portion of the map is shown in the Paullin atlas, Plate 17 D.

This list of outstanding single maps of the sixteenth century may, of course, be considerably supplemented by recourse to the great map collections that were published in atlas form during the period. The earliest of these is the Ptolemy collection of maps which was frequently revised and enlarged during the century. The Lafreri or Roman Atlas containing mostly maps printed or dated

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[61] Hakluyt Society, Extra series, Vol. IX (1904); opposite p. 112.

[62] Ibid., Extra series, Vol. I (1903); opposite p. 356.

between 1556 and 1572, some copies of which comprise as many as 142 maps, represents the first known attempt at a collection of maps in atlas form. The first really scholarly, or modern atlas, it will be recalled, was the Theatrum Orbis Terrarum, first published by Ortelius in 1570, and republished frequently thereafter in enlarged and revised form. Note may be made of the fine general map of Central Mexico appearing in the Ortelius edition of 1579.[63] It is constructed on the scale of approximately 1:2,000,000, and represents Mexico with some detail to about 22° latitude, north. The map is very creditable to the Spanish sources upon which it is based. The first, though incomplete, edition of the Mercator atlas appeared in 1595; and the first special atlas of America, the Descriptionis Ptolemaicae augmentum[64] of Cornelius Wytfliet, made up of one world map and of eighteen American maps, appeared two years later. All of these atlases contain maps showing, with varying degrees of accuracy, some part of the New World.

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[63]Cf. Vivien de Saint-Martin, Histoire de la géographie (Paris, 1873), p. 372.

[64]See Phillips, op. cit., title 1140, for a table of contents to this atlas.

## CHAPTER VIII

## THE CARTOGRAPHY OF NORTH AMERICA IN THE SEVENTEENTH, EIGHTEENTH, AND EARLY NINETEENTH CENTURIES

If Spain's territorial sovereignty on the North American continent was practically uncontested during the sixteenth century, it did not remain so in the century following, for then French, English, Dutch and Swedish competitors made successful efforts to gain a share in the exploitation and colonization of the continent. The earliest and most important of these invaders were the French. They made their entrance through the great gateway of the St. Lawrence, pushed across the continent to the foot of the Rocky Mountains and Hudson Bay, then down the Mississippi, and finally effected contact with Spanish Mexico in the eighteenth century. Almost simultaneously the English possessed themselves of the Atlantic coast from South Carolina to Maine and extended their knowledge to the Appalachian Mountains and beyond to the Mississippi, just before the end of the eighteenth century. In this same century, in the Far North, the English from Hudson Bay reached the Rockies and the Arctic Ocean, and one of their traders, Alexander MacKenzie, succeeded in crossing by land from Montreal to the Pacific coast. The Spaniards themselves extended their explorations from New Mexico to California and examined parts of the arid southwestern United States.

Besides these major contenders, there were the significant, though short-lived, attempts at colonization of the Dutch for whom Henry Hudson in 1608-09 discovered, or rediscovered, New York Harbor, the East River to Long Island Sound, and the river which bears his name. In the Delaware region a royal colony of Swedes and Finns settled on the Lower Delaware near Fort Christiana (Wilmington) in 1638. In the eighteenth century Peter the Great of Russia commissioned the Dane Vitus Bering to explore the northwestern shores of North America, and thus began Russia's claim to Alaska. With the Danes in Greenland and Iceland, and the Portuguese in early possession of parts of Labrador and Newfoundland, there were at one time or other some eight European nations who held claim to

land on the North American continent. A brief outline of the contributions made to the cartography of North America chiefly by France, England, and Spain, in the seventeenth and eighteenth centuries, is attempted in the following pages.

## The French Contributions to the Exploration and Mapping of North America

Of all the nations engaged in opening up the North American continent, the French accomplished most. Indeed, all through the seventeenth century and the first half of the eighteenth, the brilliant achievements in American exploration and cartography were all the work of Frenchmen. Part of their great success must be put down, no doubt, to the geographical advantage they derived from using the St. Lawrence Valley as their starting point, for from this valley a large number of practicable routes ran in almost every direction. It was thus not until the beginning of the seventeenth century that the grand title of "La Nouvelle France," which had been added to the maps after Cartier's voyages in the previous century, ceased to be merely a name.

Most outstanding among the names connected with the resumption of French exploration and colonization in the New World is that of Samuel de Champlain (1567-1635). His is the honor of having laid out the first path of exploration in the northern interior of North America. Champlain's first journey inland was made by way of the St. Lawrence in 1603, and his last and most important one in 1615. His reports and valuable map were published in 1632.[1] They constitute a precious record of his discoveries and surveys of Lakes Champlain, Nipissing, and Simcoe, and his visits to lakes Huron and Ontario. Champlain knew of the existence of four of the Great Lakes, though not with sufficient knowledge to permit him to make a good record and map of them.

Champlain's work was continued by the hardy adventurer, Jean Nicollet, whose explorations were almost as fertile as those of Champlain himself.[2] During his journeys from 1634 to 1635,

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[1]See Samuel de Champlain, The Works of Samuel Champlain . . . ., edited by Henry P. Biggar (6 vols.; Toronto: The Champlain Society, 1922-36); see also H. P. Biggar's The Early Trading Companies of New France (Toronto: University of Toronto Library, 1901).

[2]See C. W. Butterfield, History of the Discovery of the Northwest by Jean Nicollet in 1634 (Cincinnati, 1881).

Nicollet reached Sault Ste Marie at the outlet of Lake Superior, the Strait of Mackinac, Lake Michigan, Green Bay, and the Wisconsin River. Nicollet acted under orders of Champlain who lived just long enough to learn of these great exploits. At the time of Champlain's death in 1635, three of the five great American lakes had been at least partially explored, although knowledge of the other two, that is, lakes Erie and Superior, was still quite indefinite.

Further progress was primarily the work of two very different classes of men--the Jesuit missionaries and the fur traders.[3] More is known of the former than of the latter, for their journeys were for the most part recorded in the Relations, published by their Order in Paris.[4] In 1669 the trapper Louis Joliet made an important prospecting journey to Lake Superior and returned by way of Lake Huron, the Detroit River, Lake Erie and Lake Ontario. Four years later, Joliet set out on an even more significant voyage, this time accompanied by Father Marquette.[5] They traveled to the Mississippi by way of Lake Michigan and the Fox-Wisconsin route and followed that river to its junction with the Arkansas. They then retraced their steps to Lake Michigan by way of the Illinois River, sailed up to Sturgeon Bay, and passed again to Fox River. The grand achievement of their journey of nearly three thousand miles was the firm establishment of the general outlines of the Upper Mississippi. Their great work was to be completed, and even surpassed, by Robert Cavelier de La Salle, who was first to negotiate successfully the journey from the Great Lakes to the Lower Mississippi and the Gulf of Mexico where he arrived in February, 1682. To both Joliet and La Salle belongs therefore the merit of the discovery of the Mississippi. But the opening up of the vast and fertile valley to French enterprise was due to the ambitious and far-sighted views of La Salle alone. It was he who

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[3]A good, running history of this development is given in the work by John Bartlet Brebner, op. cit., which is provided with a select list of bibliographical references.

[4]The Jesuit Relations and Allied Documents, edited by Ruben Gold Thwaites (73 vols.; Cleveland, 1896-1901).

[5]On this much contested expedition, see Francis Borgia Steck, The Joliet-Marquette Expedition, 1673 (Washington: The Catholic University of America, 1927); the bibliography on pp. 311-23 lists practically all the important documents and other writings pertaining to this subject.

promptly took possession for his master, Louis XIV, of all the land drained by the great river and christened it "Louisiana."[6] At the close of the century the French took up the formal exploration and colonization near the mouth of the Mississippi and along the shores of the Gulf of Mexico to the east of the Mississippi delta, near Mobile. The almost continuous waterway from Quebec to New Orleans was rapidly becoming the main artery of a thinly populated French colonial empire threatened, though, from one end to the other by the English.

The first half of the eighteenth century still saw the French in the forefront of exploration on the North American continent. Their chief advance now was directed toward the more southern zone, due west of Lake Superior, where one of their number, Le Sieur du Lhut had begun to penetrate even before the close of the seventeenth century. The outstanding French pioneer of the eighteenth century, one whose devotion to the cause of discovery entitles him to rank with La Salle, was Pierre Gaultier de Varenne, Sieur de la Vérendrye, commonly known by the last name.[7] His great mission, in which he was aided by his sons, was "to discover and describe the important relation of the three lakes, Winnipeg, Winnipegosis and Manitoba, to the long rivers which come from the south and west and flow into Hudson Bay, thereby providing important avenues for the further revelation of the continent."[8] They found the upper Missouri and mapped it fairly correctly; but there is controversy on the question of whether they did or did not trace the river to its source in the Rocky Mountains. What is beyond doubt is that they thoroughly explored the crossroads of the continent, especially those leading from the Winnipeg basin to the Missouri, and that they placed the Missouri and the other great rivers of the Northwest in their proper relation to one another. Although they did not succeed in their avowed objective of reaching the western sea, they accomplished with little outside

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[6]For a modern evaluation of La Salle and his biographers, see Marc de Villiers, L'Expédition de Cavelier de La Salle dans le Golfe du Mexique (1684-1687) (Paris, 1931).

[7]The extensive literature on the Vérendryes is well covered in Lawrence J. Burpee's edition of the Journals and Letters of La Vérendrye and his Sons (Toronto, 1927); the work includes seven of Vérendrye's maps.

[8]Brebner, op. cit., p. 359.

help or encouragement such tasks as entitle them to rank with the most meritorious of the pioneers of western discovery in North America.[9]

The Vérendrye voyages mark the end of the century and a half of French exploration and discovery on the North American continent. The ever increasing tension engendered by Anglo-French rivalry led to open conflict in 1754. The decisive struggle was in the Northwest for the possession of the city of Quebec, founded by Champlain in 1608, and with the capture of this stronghold by the English in 1759, the French cause was lost, even though the war was to last for another four years. The Peace of Paris (1763) deprived France of the territories west of the Mississippi in favor of Spain, and of those to the east of the river in favor of England which also received Canada. French sovereignty on the North American continent came to a sudden end. All that was left of her vast colonial empire in the New World consisted of two little islands in the Gulf of St. Lawrence; a very few others in the West Indies; and of French Guiana in South America. Louisiana was won back to France for a brief, though anxious, moment in 1800; but in 1803 Napoleon disposed of it permanently to the United States. The French possessions extended, of course, over vastly larger regions than were occupied by the English colonies hugging the Atlantic seaboard. But the serious weakness was the small and therefore thinly scattered number of white French settlers as against the far more numerous and heavily concentrated population of English colonials. It is true, however, that not until after 1676 did the expanding populations of the coastal colonies break through the Appalachians and commence their historic march westward to the heart of the continent. By the end of the century most of the areas lying east of the Mississippi had at least been roughly explored. The lands farther west had for the most part to await their turn in the nineteenth century.

Some of the more important maps resulting from the vast amount of exploration done by the French on the continent during the seventeenth and eighteenth centuries are noted in the following pages.

Cartographically by far the most significant development during these centuries was the gradual emergence on maps of the

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[9]Edward Heawood, A History of Geographical Discovery in the Seventeenth and Eighteenth centuries (Cambridge, 1912), p. 327.

outlines of the Great Lakes and of the vast Mississippi River system. The progressive phases of this emergence can be readily followed in the maps of Champlain, Nicolas Sanson, the Jesuits, Louis Joliet, Louis de Hennepin, J. B. L. Franquelin, Vicenzo Coronelli, Guillaume Deslisle, J. N. Bellin, J. B. d'Anville, and others.[10]

The Champlain maps of 1603, 1612, and 1632, are the first really important maps of the seventeenth century. Here Champlain obtained something more than tolerable accuracy in his plotting of the country east of the Penobscot, though further west his proportions and relations were quite untrue. The map of 1632 is the most detailed of the three; it measures about 34 x 21 inches, and was first published in Champlain's Voyages de la Nouvelle France Occidentale, dicte Canada, (Paris, 1632).[11] Its chief feature is the delineation of the St. Lawrence River up to Lake Huron, and of the coast of New England and of Nova Scotia. This map circulated widely and was used by many later cartographers.

The first attempt to represent all the five Great Lakes appears on the Nicolas Sanson map L'Amérique Septentrionale, issued in 1650. The three eastern lakes, Huron, Erie and Ontario, are shown with a real approach to accuracy. But Lake Superior is only partly delineated and is joined to Lake Huron by a short and narrow strait. South of Lake Superior, and separated from it by a slender peninsula, is the Lac des Puans (Green Bay) which empties into Lake Huron. No effort is made, however, to distinguish the bay as a body of water separate from Lake Michigan. A far more detailed map of the region was issued by Sanson in 1656 as

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[10]The best work on the mapping of the Great Lakes is Louis Charles Karpinski's Bibliography of the Printed Maps of Michigan, 1804-1880, with a Series of over One Hundred Reproductions of Maps Constituting an Atlas of the Great Lakes and Michigan . . . . (Lansing: Michigan Historical Commission, 1931). See also the mimeographed list compiled by Karpinski of "Manuscript Maps, prior to 1800, relating to America; photographic facsimiles made from originals in various libraries and archives in Paris, Spain and Portugal." The list covers 986 map titles. Facsimiles of the maps corresponding to these titles are in the Library of Congress and in certain other libraries. See Karpinski's Bibliography . . . ., p. 24, for further details.

[11]An excellent reproduction of the map is included in Biggar's edition of Champlain's works, op. cit. See also Nellis M. Crouse, Contributions of the Canadian Jesuits to the Geographical Knowledge of New France, 1632-1675 (Ithaca, N.Y., 1924), pp. 31-37, for an analysis of the map.

Le Canada, ou Nouvelle France. This map and the earlier one were also included in the quarto edition of sixteen Sanson maps, entitled L'Amérique en plusieurs cartes nouvelles et exactes, ... . This work passed through several editions, the first of which appeared probably in 1656.[12] The plan of the Great Lakes is the same on both maps; it was accepted for some time to come as the standard for that region. Maps based directly upon Sanson's work, with specific acknowledgment, were published in England by Blome and William Berry.[13]

The first really significant portrayal of Lake Superior appears upon the famous map by that name, which was issued as part of the Jesuit Relation of 1670-71, published at Paris in 1672. The actual designer of the map is unknown; but it was apparently drawn "by two Fathers of considerable intelligence, much given to research and very exact, who determined to set down nothing that they had not seen with their own eyes."[14] These two Fathers were probably Dablon and Allouez. The map measures about 19 x 14 inches, and is excellently drawn and engraved. Details are delineated with considerable accuracy so that most of the places can be identified with ease. The most southerly lake shown in Wisconsin is Lake Winnebago; the large island in Lake Huron is Grand Manitou Island. It was not until the second quarter of the nineteenth century that a work comparable in magnitude and character appeared.

The first attempts to delineate the Mississippi appear on the maps of Louis Joliet and of Father Marquette. It is not certain which of the two maps has claim to priority. Joliet's earliest map was lost when his canoe capsized on his return trip to Montreal. He soon replaced it, however, by sketching another from memory.[15] This map is considered by some experts to represent the oldest map of the river. It is entitled Découverte de plusieurs nations dans la Nouvelle France en l'année 1673 et 1674. The date of the map is believed to be 1674. Another and larger

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[12]Cf. Phillips, op. cit., titles 151-53.

[13]Ibid., title 3442.

[14]Jesuit Relations . . . ., LIV, 255.

[15]A copy of the map is included with the article by Gabriel Gravier, "Etude sur une carte inconnue," Revue de géographie, VI (1880), 81 ff.

chart by Joliet, also apparently dating from 1674, shows the Great Lakes, and the Mississippi from its source to a spot just below the Ohio. Joliet is believed to have compiled at least eight maps dealing with America.[16]

Marquette's original and, perhaps, only map is now preserved at St. Mary's College, Montreal.[17] It shows, with the exception of Lake Superior, merely the route traversed by Marquette. The Mississippi is outlined only from its junction with the Wisconsin to the mouth of the Arkansas where the expedition turned back. The map is refreshingly executed with strict attention to realistic detail.

The map of Father Pierre Raffeix is interesting in that it purports to show the various expeditions made to the Mississippi River, and to illustrate possible routes to the river. The map is entitled Parties les plus occidentales du Canada; its date is either 1683 or 1688.[18] The area covered extends from Lake Superior south to the thirty-fifth parallel--a spot just below the Ohio River. Three voyages are represented: that of Joliet and Marquette; of Daniel Greysolon du Lhut to the upper Mississippi; and of La Salle to the Illinois River in 1679. The map shows generalized river courses, with the eastern tributaries of the Mississippi in roughly parallel position. Lake Michigan is of the pointed type, and Lake Erie of the flat and elongated type.

A new period in the history of the Great Lakes was inaugurated by the Recollet, Father Louis Hennepin, with his work Description de la Louisiane, which appeared in 1683 and was accompanied by the map entitled, Carte de la Nouvelle France et de

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[16]Cf. N.-E. Dionne, Inventaire chronologique des cartes, plans, atlas relatifs à la Nouvelle France et à la province de Québec (Quebec, 1909), p. 7.

[17]A facsimile reproduction of the map appears in John Gilmary Shea's Discovery and Exploration of the Mississippi Valley (New York, 1852).

[18]A reproduction of the map appears in Gabriel Alexandre Marcel's Reproductions de cartes et de globes relatifs à la découverte de l'Amérique du XVIe au XVIIe siècle (Paris: E. Leroux, 1894); see Phillips, op. cit., title 1138, for a table of contents to this atlas.

la Louisiane.[19] This map was replaced by other maps in subsequent editions of the work. Its great popularity is attested by the appearance of an Italian edition in 1686, a Dutch edition in 1688, and German translations in 1689 and 1690. At least twenty editions have been accounted for.

Far more expert than any of these map-makers was the trained cartographer, Jean Baptiste Louis Franquelin, hydrographer in Canada of the King of France. There are maps of his as early as 1679 and 1681, and as late as 1699.[20] The one which is commonly designated as "Franquelin's Great Map of 1684," has been qualified by Mr. Parkman as "the most remarkable of all the early maps of the interior of North America."[21] It is entitled Carte de la Louisiane, ou des voyages du Sieur de la Salle et des pays qu'il a découverts depuis la Nouvelle France jusqu'au Golfe de Mexique ... . The map was reproduced in 1688 under the new title of Carte de l'Amérique septentrionale, though with corrections and added detail. Parkman is, however, of the opinion that the Franquelin maps subsequent to the great map of 1684 all have more or less its features and do not equal it in interest or completeness.

Maps of a general and special character exhibiting the geography of the interior continent followed in quick succession as the century drew to a close.[22] We note, rapidly, the maps of Pierre Du Val; the map, entitled Partie de la Nouvelle France, by Hubert Jaillot (1685); the same cartographer's Amérique septentrionale of 1694, and Le Monde of 1696; the Carte générale de la

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[19]See Louis Hennepin, A New Discovery of a vast Territory in America. Reprinted by R. G. Thwaites (2 vols.; Chicago, 1903). This is a reprint of the second London edition of 1698, with facsimiles of . . . . maps. . . . . See also the bibliographical sketch by Justin Winsor, in his Narrative and Critical History of America (8 vols.; Boston and New York, 1884-89), IV, 246-56.

[20]These maps are fully listed in the still very valuable work by Henry Harrisse, Notes pour servir à l'histoire, a la bibliographie, et à la cartographie de la Nouvelle-France et des pays adjacents, 1545-1700 (Paris, 1872). On the Franquelin maps see also the copious notes and references in Lowery, op. cit., titles 189-90.

[21]Francis Parkman, La Salle and the Discovery of the Great West (11th ed., Boston, 1898), p. 484.

[22]See Harrisse, op. cit.; and also Phillips, op. cit.

Nouvelle France (1692), engraved by Boudan; the Amerique septentrinonale of De Fer (1693); and the marine Cartes (1696) of Le Cordier.

This list of single maps issued during the century may be considerably augmented by the inclusion of maps published in atlas form during the period.[23] The first of these atlases, in point of time, was the Mercator-Hondius atlas, the fourth edition of which included ten American maps. The edition of the atlas published with a Latin text as Atlas novus differs in its general description of America from the French edition of the atlas which appeared in the same year. Similarly, the Atlas novus issued by the famous Blaeu firm in 1638 contained fourteen American maps. But these Blaeu maps as well as the maps of Blaeu's compatriots, Jansson and Visscher, deserve little notice as contributions to American cartography, for they singularly ignore all that the cartographers of New France had for long been divulging. The same misrepresentation was, moreover, continued into the later Blaeu atlas of 1685, where a variety of equally unfounded notions made their appearance on still other American maps. It may also be noted that the Sanson maps of America, previously mentioned, were included in the Hubert Jaillot Atlas nouveau ... ,[24] issued during the years from 1692 to 1696.

American cartography in the eighteenth century opens most auspiciously with the map work of the great French cartographer, Guillaume Delisle. His earliest American map, entitled Amérique septentrionale, was first issued in the year 1700.[25] His more famous Carte de la Louisiane et du cours du Mississippi dates perhaps from the year 1710. It has been qualified by Kohl as "the mother and main source of all the later maps of the Mississippi and of the whole West of the United States." This map passed through several editions and was included in the Atlas nouveau, which covers Delisle's maps dating from 1700 to 1726 and was issued by Covens and Mortier of Amsterdam in 1733. Delisle's cartographic establishment was carried on by his nephew, Phillippe Buache.[26]

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[23]See Winsor, op. cit., IV, 377-93.

[24]See Phillips, op. cit., title 3452.

[25]See Lowery, op. cit., title 247.

[26]See Phillips, op. cit., title 3512; and Lowery, op. cit., title 314.

Even greater eminence attaches to Delisle's famous compatriot J. B. Bourgignon d'Anville, who began to publish maps about 1730. His map of Canada, Louisiane et terres Anglaises was first issued in 1755, and passed through several French and English impressions.[27] Many of d'Anville's maps were incorporated in the atlases of the English cartographer Thomas Kitchin and appeared thus until the beginning of the nineteenth century.

Contemporary with the work of d'Anville was that of Jacques Nicolas Bellin, the hydrographer of the French marine. Bellin is credited with many maps.[28] We note merely that he supplied the maps for Charlevoix' great work, Histoire et description générale de la Nouvelle France, which appeared in Paris in 1744. Bellin's representation of the Great Lakes marks a notable advance over the maps of the time, although it was not until the government surveys of the nineteenth century that the faulty cartographic norms assumed for the lakes were at last corrected.

As has already been pointed out, the Vérendrye voyages in the Northwest during the first half of the eighteenth century mark the end of a century and a half of unrivaled French eminence in American exploration and cartography. By the peace treaty of 1764, France abdicated its political sovereignty in America in favor of England, and with it went its primacy in the mapping of that continent. Before we attempt, however, to trace this emergence of English leadership in the cartography of North America, we must briefly point out that French maps dealing with America, and French atlases of this nature, continued to enjoy popularity almost to the end of the century. We note especially the atlases of Gilles Robert de Vaugondy and of his son Didier. Both Vaugondys held the position of "Géographe du Roi." The elder Vaugondy was the nephew of Pierre Moulart Sanson--himself a nephew of one of the sons of Nicolas Sanson, the founder of the school of cartographers by this name. To both of the Vaugondys are due atlases in which appear numerous maps of America. The earliest of these, the Atlas portatif ... ,[29] was first issued by the elder Robert

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[27]Lowery, op. cit., title 408.

[28]For a critical evaluation of Bellin's maps, see William F. Ganong, A Monograph on the Cartography of the Province of New Brunswick . . . . (Ottawa, 1897). See also Phillips, op. cit., title 587 ff.; and Lowery, op. cit., title 368.

[29]See Phillips, op. cit., titles 608, 649.

de Vaugondy in 1748, and reissued by his son Didier in 1778, 1784, and again as late as 1794. Their great Atlas universel ... appeared first in 1757.[30] In the revised and enlarged edition of this atlas published about 1793, there appears the notable map of the United States of North America, by Charles François Delamarche.[31] It is dated 1785, and gives a list of the thirteen original states, with Vermont, and the proposed names of the ten new states provided for in the Jeffersonian ordinance of 1784, i.e., Sylvania, Michigania, Chersonesus, Assenisipia, Metropotamia, Illenoia, Saratoga, Washington, Polypotamia, Pelisipia. This famous map may be said to conclude the long and brilliant series of original contributions made by Frenchmen to the cartography of the North American continent. Leadership in the mapping of America had in the meantime passed to England.

## English and Dutch Contributions to the Cartography of the Atlantic Coast Colonies[32]

Quite in contrast with the French, the English movement inland from the Atlantic coast was long-drawn out and accomplished piece-meal, with practically no great integrating recorders present such as the French possessed in Champlain and La Salle. It opened with the arrival of Gosnold in Massachusetts in 1602; with the examination of the coast of Maine by Pring in 1603; and the exploration of the Penobscot River by Weymouth in 1605. Jamestown was settled by the English in 1607, and in the same year John Smith commenced his work in Virginia and along Chesapeake Bay.

New England cartography had its real inception in the seventeenth century with Captain John Smith whose original map of

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[30] Ibid., titles 619, 3524.

[31] Ibid., title 678.

[32] On this section consult the following: Stokes, op. cit., II, 1-40; these pages correspond to an article by F. C. Wieder, entitled Essay on the Development of Knowledge regarding the East Coast of North America. See Winsor, op. cit., II and IV; also Georg Michael Asher, List of the Maps and Charts of New Netherland, and of the Views of New Amsterdam (New York, 1855), which work is still valuable; a more recent map list is entitled Manhattan Maps, A Co-operative List, edited by Daniel C. Haskell (New York: New York Public Library, 1931); see also F. C. Wieder's Monumenta Cartographica. Reproductions of Unique and Rare Maps, Plans and Views in the Actual Size of the Originals (5 vols.; The Hague: M. Nijhoff, 1925-33). See also Archer B. Hulbert, ed., The Crown Collection of Photographs of American Maps (5 vols.; Cleveland, 1904-08); see Phillips, List of . . . Atlases, titles, 1191, 3664.

the region dates from 1614. His more famous map of Virginia dates from 1612.[33] The oldest map of the territory now comprising the states of New York, New Jersey, and Delaware, is the so-called "Figurative map" dating from about 1616, and drawn by an unknown author. Pure local work came in with the map which accompanied William Wood's New England Prospect, published at London in 1634. The map bears the inscription: "South Part of New England as it is Planted this Yeare, 1634." It shows the coast only from Narragansett Bay to "Acomenticus" on the Maine shore, with corresponding inland delineations. The maps of New England and New York which are included with John Speed's Prospect of the Most Famous Parts of the World, a new edition of which was issued in 1676, are chiefly based on the maps of Visscher and of other Dutch cartographers. John Seller's map of New England is approximately of the same date. It is entitled A Mapp of New England, and shows the coast from the Kennebec to beyond the Connecticut River.

Perhaps the earliest map of the Delaware territory was produced by Mans King for the Swedish government in 1638; and a map on a much larger scale was drawn of the Delaware River and Bay by the Swedish engineer R. Lindstrom in 1654.

The first printed map of the New Netherland is to be found in Johan de Laet's Novus orbis, published at Amsterdam in 1630. The map is entitled Nova Anglia, novum Belgium, et Virginia; it delineates Lake Champlain, and especially Cape Cod, with a good approach to accuracy. Of the later Dutch charts and maps relating to the colonies along the eastern coast of North America, first place must no doubt be accorded to those appearing in the sea-atlas issued by Arend Roggeveen, dating from about 1675. The atlas appeared in several languages, and includes charts of New England, New Netherland, the Carolinas, Chesapeake Bay and Delaware Bay.[34]

It was not until the last quarter of the century that the expanding populations of these coastal colonies, extending from

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[33]A reproduction of the map is included in Alexander Brown's Genesis of the United States (2 vols.; Boston and New York, 1897). On the maps of Virginia, see also the article on "Maps Relating to Virginia in the Virginia State Library . . . ." Virginia State Library, Richmond. Bulletin, Vol. VII, Nos. 2-3 (1914).

[34]For a list of Dutch atlases see also Pieter Anton Tiele, Nederlandische Bibliographie van Land-en Volkenkunde (Amsterdam, 1884).

South Carolina to Maine, penetrated the Appalachians and spread slowly toward the Mississippi. No systematic explorations accompanied these movements, for it was not until 1748 that "the first official journey was undertaken at the instance of the English colonies to the west of the mountain wall."[35]

In England, in the early eighteenth century, Hermann Moll and John Senex were especially active in the production of maps relating to America--based chiefly, of course, on the Delisle maps. The most prolific of the two, Moll, was a Dutchman who came to London in 1689. Among the numerous American maps included in his Atlas minor, the first edition of which appeared in 1729, may be seen the earliest known map relating to post routes in the United States.[36] An even more significant name is that of the standard English cartographer, Henry Popple. His great Map of the British Empire in America with the French and Spanish Settlements adjacent thereto was first published, in twenty sheets, in 1732, and again in 1733 and 1740.[37] The map remained the standard one for more than twenty years.

It is a remarkable fact that no single year of the century brought forth so many really notable maps as did the year 1755--the year of the outbreak of the French and Indian wars. American cartography was practically revolutionized by the appearance of two maps, one on either side of the Atlantic, which combined with a certain amount of French information much that was new and essentially British. In particular the Englishman, John Mitchell, who had lived in America, published in that year at London a majestic map entitled A Map of the British and French Dominions in North America . . . ., in twelve sheets, which dominated the accepted cartography of America until even after the peace of 1783.[38] The influence exerted by this great map may be judged by

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[35]Reuben Gold Thwaites, Early Western Travels, 1748-1846 (32 vols.; Cleveland, 1904-07), I, preface. This work is indispensable for the study of the early history of exploration in the United States. See also, Brebner, op. cit., and J. N. L. Baker, A History of Geographical Discovery and Exploration (London, 1931).

[36]Phillips, op. cit., title 574.

[37]See the notes and references on this map, in Lowery, op. cit., title 338.

[38]Cf. Ibid., title 426.

the fact that it was the fundamental map accepted for the determination of the boundaries between the United States and Canada. The map was reprinted many times in England, with modifications largely in the eastern part of the United States. Various editions of it were published in Holland and France, and what was really an Italian edition of the map was issued in 1778, in Italy, by Antonio Zatta in a series of twelve maps, entitled Colonie Unite dell'America Settentrionale ...[39]--perhaps the first appearance of the equivalent of the name "United States" upon a map. A facsimile of the fourth edition (1775) of the English map--the Steuben-Webster copy--was issued on a reduced scale in 1933 by the United States Department of State as a supplement to Volume III of Treaties and other International Acts of the United States of America.

The other most important map published in the year 1755 is the Lewis Evans map. It was printed on the press of Benjamin Franklin and David Hall in Philadelphia under the title of A General Map of the Middle British Colonies, in America; viz. Virginia, Maryland, Delaware. . . . .[40] The map is based, as far as the West is concerned, on surveys made by Gist, Walker, and various other recent explorers, and was hurried in its publication in order to be of use in Braddock's expedition. The map circulated widely in England and on the continent as well as in the United States, though its influence was somewhat less than that of the Mitchell map.

The establishment of peace between England and France in 1763, and the outbreak of the War of the Revolution gave rise to numerous maps and atlases dealing with America. Most active in this field were, in England: Emanuel Bowen, Thomas Kitchin, William Faden, and especially Thomas Jefferys; in France; Rigobert Bonne, Nicolas Demarest, George Louis Le Rouge, and the Vaugondys. Of the English maps of America, those engraved by Jefferys and included in his American Atlas . . . .,[41] issued by Sayer and Bennett of London, first, in 1775, and again in 1776 and 1782, proved the most popular. A French edition of the atlas was

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[39]Ibid., title 691a.

[40]Henry N. Stevens, Lewis Evans, his Map of the Middle British Colonies in America . . . . (London, 1920).

[41]See Phillips, op. cit., title 1165.

published by Le Rouge in 1778 as l'Atlas Amériquaine septentrionale ...[42] with the famous Mitchell map of 1755 as a supplement. These two editions of the American atlas are believed to have been "the most widely used military atlases of the Revolutionary War." Even wider circulation was accorded the Jefferys maps through their inclusion in the numerous editions of Thomas Salmon's New Geographical and Historical Grammar, which was very popular from 1749 to 1800.

Although the maps which accompany the American Geography . . . . issued by Jedidiah Morse in 1794 in London cannot be regarded as an atlas, they constitute nevertheless a collection of the earliest maps of the states in the union.[43] The famous Aaron Arrowsmith Map Exhibiting All the Discoveries in the Interior of North America, which was first issued in London in 1795, and many times thereafter with additions and corrections, may fittingly conclude this rapid sketch of the mapping of the Atlantic coastal colonies.

## English Exploration and Mapping in the Northwest: Canada[44]

The country in the far north and to the south and west of Hudson Bay was also explored mainly by the English. In fact, it was largely through the activities of the English Hudson Bay Company, founded in 1670, that the development of the interior of

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[42] Ibid., title 1212.

[43] Ibid., title 1361.

[44] On this section consult the following sources: Lawrence J. Burpee, The Search for the Western Sea, the Story of the Exploration of Northwestern America (2 vols., rev., New York: Macmillan Co., 1936); this is the standard work on the northwest voyages; reproductions of the following maps are included in the volumes: "A New Map of North America," by Moll; a "Map of Hudson Bay," (1790), by Turner; a map laid down from the sketches of Peter Fidler; a "Map of Hudson Bay's Country," (1785), by Peter Pond; a "New Map of North America," from Carver's Travels (1778); a "Map of the Copper-Mine River," 1771, by Samuel Hearne; and an exact reproduction of the western portion of David Thompson's manuscript map of northwestern America (1813-14). See also Philip Lee Phillips, Alaska and the Northwest Part of North America, 1588-1898; Maps in the Library of Congress (Washington: Government Printing Office, 1898). Pp. 119; this is a very useful map list. See also Paul Fountain, The Great North-West and the Great Lake Region of North America (London: Longmans Green and Co., 1904); and the Historical Atlas of Canada, edited and supplied with an introduction, notes, and chronological tables by Lawrence J. Burpee (Toronto and New York, 1927)

northwest America was due, for the company had been founded for the double purpose of promoting discovery as well as trade. Its most significant contributions to exploration were made in the eighteenth century. The name most prominently associated with them is that of Samuel Hearne who, in 1769, commenced three years of remarkable exploration northwest of Hudson Bay. The results of Hearne's great discoveries were first revealed to the public through their incorporation, in 1784, in the map accompanying the report of Captain James Cook's third voyage.[45]

Cook's third, and final, voyage had to do with the probing of a possible route to the Atlantic by way of Berring's Strait. Cook sailed through the Strait in August 1778 and went as far as the western extremity of America in latitude 65° 46'. He died the following winter, and the voyage was completed by Captain Charles Clerke who was able to reach the high latitude of 70°33'. Though the problem of the northwest passage was not disposed of by this voyage, Cook's extended scientific surveys in that region supplied the first definite knowledge concerning the contour of western North America from the latitude of California to Cape Prince of Wales.

An even more extensive pacific coast survey was made in the last decade of the century by one who had served his apprenticeship in maritime discovery under Cook, namely, Captain George Vancouver. Vancouver arrived on the Pacific coast in 1792 and, proceeding northward from latitude 39° 30', made "a survey hardly to be matched for thoroughness in the whole history of pioneer voyages."[46] He made a similar survey southward to a point as far south as San Diego. His reports and maps were published in 1798. The map is entitled A Chart Showing Part of the Coast of North America; it was drawn by Lieutenant Edward Roberts. Vancouver's work in which the map is included, is entitled A Voyage of Discovery to the North Pacific Ocean and Round the World; it was published in London in 1798. The map measures about 24 x 31 inches, is laid out on the Mercator projection, and has Greenwich as the prime meridian. It is most noteworthy that the surveys and maps

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[45]J. B. Tyrrell has edited with excellent maps and photographs the 1795 edition of Hearne's A Journey from Prince of Wales's Fort in Hudson's Bay to the Northern Ocean (Toronto: The Champlain Society, 1911).

[46]Heawood, op. cit., p. 289.

of Vancouver, like those of Cook, have stood the test of time and are not yet wholly superseded.

It may be recalled that the first United States surveys along the Pacific coast were made at the same time Vancouver was engaged there in similar work for the British. The United States' surveys were in the charge of Captain Robert Gray who, in 1792, discovered and explored the lower part of the great river system to which he gave the name of his ship, namely, "The Columbia." The whole region was jointly occupied by British and American interests until 1846 when the political boundary was finally established at the forty-nineth parallel, giving to the United States claim to the territory south of that line. Within two years of that date California came under the American flag, and the United States coast line on the Pacific was fixed as at present.

The end of the eighteenth century and the beginning of the nineteenth saw the exploration of British North America proceed with increased vigor. Alexander Mackenzie, Philip Turner, Peter Fidler, W. D. Harmon, and particularly David Thompson, are the names especially noteworthy during this period. Alexander Mackenzie's great journeys from Montreal to Fort Chipewyan and from there to the North Sea in 1789 and to the West Pacific ocean in 1793 are exhibited on A Map of America between Latitudes 40° and 70° North and Longitudes 45° and 180° West, published in London in 1801.[47] D. W. Harmon's travels covered nearly every section of what is now Western Canada, from Lake Superior to Northern British Columbia, and from the International Boundary north to Great Slave Lake. His map, although largely based on Mackenzie's, shows many important additions and improvements and was probably at the time it was published (1820), the most complete and accurate map of the northern half of the continent. The map is included in Harmon's work: A Journal of Voyages and Travel in the Interior of North America . . . ., published at Andover in 1820. The work of Thompson was of even greater scope and significance. It has been said of him that "he was one of the greatest explorers of all time, and probably the greatest of all those who opened up the New World."[48] His surveys were,

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[47]See A. P. Woollacott, Mackenzie and his Voyageurs; by Canoe to the Arctic and the Pacific, 1789-93 (London and Toronto, 1927).

[48]Baker, op. cit., p. 368.

moreover, of such high order that parts of his maps have not yet been replaced.

Subsequent exploration and mapping in Canada comes more and more under the care of the Geological Survey of the Dominion government--established in 1840--and the survey work of the provincial governments. An able summary of the progress made by government and private surveyors during the past several decades may be read in the work by Baker.[49] That there still remain in Canada large areas that have not yet been explored is, of course, a fact.[50] But there as here in the United States, aerial photography is used very extensively in the mapping of the vast regions in the West that are still unexplored or unsurveyed. A chapter on the current government maps and mapping services of Canada has been appended elsewhere.

## Spanish Exploration and Mapping in Upper and Lower California

British exploration in the Northwest and along the Pacific coast, and Russian exploration along the Alaskan coast,[51] had their earlier counterpart in Spanish expeditions to the Pacific coast regions of the Californias. That Spain's penetration of these regions was slow and halting is perhaps explained by the meager attractions which this arid and mountainous country had to offer to adventurers and settlers. The lure of gold that was ultimately to bring about the development of the Pacific Southwest was still far away. In fact, knowledge of Lower California and of the mainland opposite it was obtained in the seventeenth and eighteenth centuries chiefly as a by-product of the missionary enterprises of Jesuits and Franciscan friars. The great pioneer among them was the Tyrolese Jesuit, Father Eusebio Francisco Kino, whose missionary work and explorations commenced in 1683 and were carried on until 1702. Kino's work virtually solved the problem of the geographical nature of Lower California. The map which

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[49]See Baker, op. cit., pp. 370-75.

[50]See, for example, Charles Camsell, "The Unexplored Areas of Continental Canada," Geographical Journal, XLVIII (1916), 249-57.

[51]See Robert J. Kenner, "Russian Expansion to America, its bibliographical foundations," Bibliographical Society of America, Papers, XXV (1931), 11-29.

incorporates the results of his journeys shows that region not as an island, but indeed as a peninsula, which was contrary to maps published at the period.[52] Kino's great map is thus a landmark in the cartography of the west coast. It was first published in Volume V of the Lettres édifiantes ... which appeared at Paris in 1705, and bears the title Mapa del paso por Tierra a la California.[53]

Kino and the other Jesuits whom he fired to emulation laid the foundation for the advance, later in the century. to Upper California and the Northwest, notably by the Franciscan monks Fray Francisco Garces, Francisco Dominguez, and Silvestre Velez de Escalante. The latter undertook with his party in 1776 and 1777 a circuitous journey through the mountains and valleys of the modern states of New Mexico, Colorado, Utah, and Arizona.[54] Their journey marks the farthest advance of the Spaniards into the interior of North America. A most valuable map, possibly copied directly from the original field sketches, is represented by the Plano geografico, de la tierra descubierta, y demarcada por Dn. Bernardo de Miera ... y fr. Silvestre de Esclante ..., which map dates perhaps from the year 1777.[55] It is without signature. The great value of the map resides in the fact that it is a record of the most important explorations achieved before the nineteenth century in the southwest of the present United States.[56] Spanish enterprise did not absolutely end in North

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[52]See "Notes upon the First Discoveries of California and the Origin of its Name," contributed by Jules Marcou to U.S. War Department, Annual Report of the Secretary of War for the Year 1878, Vol. II, Part III, pp. 1648-51. This is an interesting discussion respecting the various maps of California and brings out the differing opinions that were held as to its being an island or a peninsula.

[53]See Lowery, op. cit., title 250, for valuable notes and references.

[54]See Irving Berdine Richman, California under Spain and Mexico, 1535-1847 (Boston and New York, 1911), which includes a separate map showing twenty-two Spanish and American trails of historical significance.

[55]See Lowery, op. cit., title 593.

[56]Attention should be called to the "Karpinski Series of Reproductions," which include a complete series of Spanish manuscript maps relating to American history. A list of institutions having sets of the Karpinski series on file, is given on p. 24 of Louis C. Karpinski's Bibliography . . . ., op. cit.

America with the exploits of Escalante and Dominguez, but it did not again contribute importantly to new exploration. Further exploration and mapping of the Californias was not undertaken until the advent of the United States government surveys about the middle of the nineteenth century. Of these a brief recital is given in the next chapter.

## Beginnings of Cartography in the United States

If the leadership in the mapping of the North American continent passed in the eighteenth century from France to England, it did not remain there very long, because the War of Independence forced England to divide her sovereignty on the continent with the new-born United States. It is well known that even during the war General Washington bitterly complained to Congress about the want of accurate maps, "which," he wrote in January, 1777, "has been of great disadvantage to me."[57] Washington's complaint gave, no doubt, a direct impetus to the birth and development of cartography as a native science in the United States, for in the following year steps were taken to remedy the want of maps by the appointment of Robert Erskine as geographer and surveyor to the army. The maps resulting from the Erskine surveys form a most valuable collection of highway maps. Nearly all date from the years 1778 to 1780. They are now in the possession of the New York Historical Society.[58]

It was also in 1778 that appeared what was perhaps the earliest imprint of the title "United States" upon a map. The map was published at Paris with the title of Carte du théâtre de la guerre ..., and was signed by J. B. Eliot, "ingénieur des Etats-Unis."[59]

The peace of 1783 naturally gave rise to a number of maps of the United States. We note rapidly some of the more important

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[57] Writings of George Washington, collected and edited by Worthington Chauncey Ford (14 vols.; New York, 1889-93), V, 210.

[58] Cf. Library of Congress. Noteworthy Maps, No. 2, Accessions 1926-27, compiled by Lawrence Martin and Clara Egli, of the staff of the Division of Maps (Washington: Government Printing Office, 1929), p. 10.

[59] Philip Lee Phillips, A List of Maps of America in the Library of Congress (Washington: Government Printing Office, 1901), p. 859.

of these. Early in 1784 Abel Buell of New Haven, Connecticut, issued his New and Correct Map of the United States of North America . . . ., and claimed for it, apparently with truth, that it was the first map "ever compiled, engraved, and finished by one man, and an American."[60] The map had its most important use in connection with the establishment in 1785 and 1786, of the southwestern boundary of the United States. Also dating from the year 1784 is the noteworthy map of the United States compiled by William McMurray, "the late geographer to the United States." This map represents perhaps a close approach to an official delineation of the newly formed republic.

The first road maps of the United States were compiled and published by Christopher Colles of New York in 1789.[61] A large map of the country showing the development of the post-routes was issued by Abraham Bradley, junior, in 1797.

The first American Atlas, consisting of American maps only, made its appearance in Philadelphia in 1795.[62] Its publisher was Mathew Carey who, in this same year, also issued a General Atlas in which he included maps of Europe.[63] The popularity of these atlases was so immediate that Carey followed them up with the issue of an American Pocket Atlas in the following year.[64] This atlas passed through at least five editions. Still another American Atlas was published in 1796 by John Reid of New York.[65]

The popularity of the Carey atlases, and of the geographies and gazetteers of Jedidiah Morse, extended well into the nineteenth century. These works were, of course, in time superseded by scientifically more accurate and up-to-date map publications, which could benefit directly from the information made available by the systematic government surveys of the nineteenth century. This development will form the subject-matter of the next chapter.

The names of map-makers most prominent in the United States at the turn of the century and in the early decades following, it may be recalled, were those of Mathew Carey and his

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[60] Noteworthy Maps, No. 2, op. cit., p. 16.

[61] Phillips, List of Geographical Atlases, op. cit., title 1326.

[62] Ibid., title 1362 ff. [63] Ibid., title 1365.

[64] Ibid., title 1364. [65] Ibid., title 1366.

son Henry Charles; John Melish; Henry Schenk Tanner; Anthony Finlay; Samuel A. Mitchell; Alvin J. Johnson, and George W. Colton. Among the earlier of these commercial map-makers the name of Henry Schenk Tanner is particularly deserving of mention for he was truly a scientific cartographer who produced some excellent map representations of the United States. Tanner's work is chiefly set forth in two publications, his New American Atlas, and his large map of the United States. The atlas was first issued in five instalments from 1818 to 1823.[66] It passed through several editions at least as late as 1839, and is remarkable for its concept of uniformity of scale. Each state or group of states is shown on the scale of fifteen geographical miles to the inch, or very nearly 1:1,000,000, that is, a scale which would be large for most states even in a modern atlas. A supplementary Geographical Memoir lists and discusses the sources. His other work is a large map of the United States on exactly the scale of 1:2,000,000. The mastery of the cartographic sources relating to the United States which Tanner had acquired in the course of preparation of his map is attested by an accompanying booklet, entitled Memoir on the Recent Surveys, Observations, and Internal Improvements in the United States. The map was first published in 1829, and passed through several editions as late as 1844.[67]

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[66] Ibid., title 1374 ff.

[67] Phillips, List of Maps of America, op. cit., p. 885.

# CHAPTER IX

## EXPLORATION AND MAPPING IN THE UNITED STATES IN THE NINETEENTH CENTURY

The beginning of the mapping of the vast area of the United States lying to the west of the Mississippi may be said to date from the memorable expedition of Captains Merriwether Lewis and William Clark who ascended the Missouri River to its source and then descended the Columbia River to the Pacific, during 1804-06.[1] A preliminary map of the country lying between the Missouri and the ocean was constructed by Lewis during the first winter in camp from data supplied by Canadian voyagers and Indians visiting their quarters. The map is known as the "Lewis map of 1806."[2] A comparison of this more or less theoretical map with the "Clark map of 1810,"[3] copied by Samuel Lewis from the original drawings of William Clark, shows to what extent the two explorers were actual discoverers. They found it first of all necessary to correct their belief about the width of the continent, for they found it much wider than they had supposed and had shown it on their map of 1806. They found also that the Columbia was not merely a Pacific coast stream, but a mighty river draining a vast interior valley, or series of valleys, between the Cordilleras and the Coast Range. The Missouri they observed to head in the

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[1] A very able summary of the official exploring expeditions in the United States from 1804 to 1857, has been contributed by Lieutenant G. K. Warren in his "Memoir to Accompany the Map of the Territory of the United States from the Mississippi River to the Pacific Ocean." The memoir is dated 1859 and forms pp. 17-91 of U.S. War Department, Reports of Explorations and Surveys to Ascertain the most Practicable and Economical Route for a Railroad from the Mississippi to the Pacific Ocean, Vol. XI (Washington, 1855).

[2] The map appears in Vol. IV (pocket) of Elliot Coues' History of the Expeditions under the Command of Captains Lewis and Clark (New York, 1893).

[3] Clark's original drawings are reproduced in Reuben Gold Thwaites' Original Journals of the Lewis and Clark Expedition 1804-1806 (New York, 1905), Vol. VIII. This is the best edition of the works of Lewis and Clark.

northwest and not in the southwest. The delineation of the Missouri and Columbia rivers forms, indeed, the real and most valuable contribution of Lewis and Clark to the early geographical knowledge of the United States. Up to 1805 only the lower course of these two rivers was known. It fell to Lewis and Clark to fill in the gap extending along their upper waters and over the continental divide, and this they did with considerable accuracy. Their work laid the foundation of the scientific exploration of the far West.

While Lewis and Clark were away in the distant West, Lieutenant Zebulon M. Pike was exploring the Mississippi upward from its junction with the Missouri. Pike's more famous journey in search of the headwaters of the Red and Arkansas rivers was made during 1806-07. Though these objectives were not realized, Pike was first to supply the government with accurate information about New Mexico, Texas, and northern Mexico. Cartographically, the results were recorded on the Pike maps of 1810. One of these shows the Mississippi from the mouth of the Missouri to Leech Lake; another indicates the supposed positions of the Platte, Arkansas, and Red rivers, from their mouths to their sources; and a third map depicts New Spain.[4]

Another search for the sources of the Red River was made by Major Stephen Long in 1819. The map which records the results of this expedition embraces an area extending from the meridian of Washington to the Rocky Mountains, between latitudes 33° and 47°. It shows the Black Hills of Nebraska correctly trending north and south instead of northwest as represented on the Clark map. This is, therefore, the first original map showing the correct direction of this mountain group.[5]

West of the Rocky Mountains the country was at this time still practically unknown to Americans, and even the Spaniards had but an indifferent acquaintance with its general features. Indeed, no American had as yet penetrated to the drainage areas of the Colorado and the Interior Basin. A great strip, widening as it went westward from the Missouri to the Spanish missions of the Pacific, could be laid down on the map at this time and

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[4]See Elliot Coues, The Expeditions of Zebulon Montgomery Pike during 1805-6-7 (4 vols.; New York, 1895), the fourth volume of which includes the Pike maps.

[5]Warren, op. cit., p. 25.

inscribed terra incognita. The great task of exploration, if not of primary discovery, between the Missouri and the mountains had yet to be accomplished. Just how little the advance was that had been realized in the cartography of the far West since the Clark map of 1810, may be seen from an examination of the Anthony Finlay map of North America, published at Philadelphia in 1826. This map claims to depict "all the recent geographical discoveries," but reveals in reality that "no advancement had been made in accurate knowledge of the regions west of the Rocky Mountains since the explorations of Lewis and Clark."[6]

But if Lewis and Clark laid the foundations of the scientific exploration of the West, fur traders and trappers added considerably to its further extension and development. Outstanding among these pioneers were the names of John Colter; Manuel Lisa; John Astor; Peter S. Ogden; James Bridger; William Ashley, and Jedediah Smith. Smith's contributions to exploration and cartography are especially noteworthy, for they "entitle him to rank with Lewis and Clark in the group of foremost American explorers."[7] Smith's explorations were made during the years from 1824 to 1830. During this time he crossed and recrossed the American West from the upper Missouri southward to the Platte, the Columbia, and the Colorado rivers, and westward to the Pacific. He had intended to publish his journals and prepare an atlas in order to correct the prevailing misconceptions about the geography of the West, but an untimely death frustated this. Some of his expert knowledge did, however, find embodiment in two maps of the period. The first of these is the careful map which accompanies Albert Gallatin's article, entitled Synopsis of the Indian Tribes within the United States.[8] This map was chiefly based on data made available by Smith, and was probably the best map of the West at the time of its publication in 1836.[9] The second map to which Smith contributed is included in the Reverend Samuel Parker's Journal of an

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[6] Ibid., p. 30.

[7] The Ashley-Smith Explorations and the Discovery of a Central Route to the Pacific 1822-1829 . . . ., edited by Harrison Clifford Dale (Cleveland, 1819), p. 53.

[8] Transactions and Collections of the American Antiquarian Society, Vol. II (1836); the map faces p. 264.

[9] Ashley-Smith Explorations . . . ., op. cit., p. 305.

Exploring Tour Beyond the Rocky Mountains, published at Ithaca, New York, in 1838. This map covers an area less extensive than does the Gallatin map, but excels the latter in other respects.[10]

Considerable geographic detail was added to the map of the West by a number of smaller surveys.[11] Among these may be noted, J. C. Brown's survey of the Santa Fe trail from Fort Osage to Taos, from 1825 to 1827; the activities of the Boundary Commission entrusted with carrying out the provisions of the Treaty of Ghent; and the work of the well-known Henry R. Schoolcraft. The latter had accompanied General Lewis Cass in his expedition to the sources of the Mississippi in 1820, and published an interesting description of it, supplemented by a map exhibiting the region bounded by the 1st and 21st meridians west from Washington, and the 41st and 51st parallels.[12] In 1832, Schoolcraft and Lieutenant J. Allen made the first topographical and hydrographical survey of the sources of the Mississippi in Lake Itaska. Schoolcraft's narrative of this expedition was published by Harper and Brother of New York in 1834, and with it was issued the first accurate map of the sources of the Mississippi River. The map was the work of Lieutenant Allen.

The first correct delineation of the river system west of the Rocky Mountains is shown on the maps incorporating the results of Captain B. L. E. Bonneville's expedition to the Rocky Mountains, from 1832 to 1836.[13] Although the geographical positions shown on the map are not accurate, the existence of the great interior basins without outlet to the sea, of Great Salt Lake, and of Mary's or Ogden's River, was determined by Bonneville. His maps also eliminated the fantastic Rio Buenaventura and other hypothetical rivers which adorned so many maps of the period. Bonneville's narrative and maps were edited by Washington Irving under the title of The Rocky Mountains; or, Scenes, Incidents, and Adventures in the Far West, and published by him at Philadelphia in 1837. It should perhaps be noted that the later editions of this work do not usually reproduce the original maps.

Very important contributions to the geography of the Mississippi Valley were made from 1836 to 1840 by I. N. Nicollet of

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[11]Warren, op. cit., p. 26 ff. [12]Ibid., p. 29.

[13]Ibid., p. 31; but compare also the Gallatin-Smith map, noted previously.

the Corps of Topographical Engineers. Nicollet was assisted during three years by John Charles Fremont who soon thereafter was to become an outstanding explorer in his own right. The results of Nicollet's fine work were recorded on two maps published respectively in 1842 and 1843. Both of the maps cover parts of the Mississippi Valley and the adjacent regions and have been qualified by Warren as among the "greatest contributions ever made to American geography."[14]

What Nicollet accomplished in large areas east of the Rockies, Captain John Charles Fremont was to achieve in the country lying between the Columbia, the Pacific Ocean, and the Spanish possessions in California. Fremont made his first expedition in 1842; it was short and rather insignificant. His second expedition was made between 1843 and 1844; it is the most important one. The third terminated in California where Fremont became involved in military activities; the fourth ended disastrously in the snow covered passes of Colorado, and the fifth, in 1846, ended similarly in the same mountains.[15] Fremont's report of his second expedition is a valuable document. In it he traces the essential differences between East and West, and describes the river systems and economic prospects of the Oregon country. The most valuable map resulting from the expeditions was produced in 1848 by Fremont's able cartographer, Charles Preuss, with the title of Map of Oregon and Upper California from the Surveys of John Charles Fremont and other Authorities. The map is on the scale of 1:300,000, and embraces all the area between the 104th meridian and the Pacific Ocean, and between the 32nd and the 50th parallel of latitude. It was at the time by far the best map of its kind.

While these major expeditions were in progress, minor contributions to the map of the United States resulted from the boundary surveys between Louisiana and Texas; the journey of Captain J. Allen to the sources of the Des Moines River in 1843; the exploration by Captain N. Boone of the unknown area lying between the Arkansas and Canadian rivers as far west as the 100th meridian; the surveys of Lieutenants J. W. Abert and W. G. Peck west

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[14] Ibid., p. 40.

[15] The best work on Fremont's explorations is by Frederick S. Dellenbaugh, Fremont and '49; the Story of a Remarkable Career and its Relations to the Exploration and Development of our Western Territory, Especially California (New York, 1914).

of this meridian, and southward from the Arkansas to the north fork of the Red River, between 1846 and 1847. All these explorations and surveys were recorded on maps.[16] We may note, as one among several, Harper's Map of the United States and Canada, which was published by Harper and Brother of New York in 1847, and compiled by Samuel Breese.

In the southwest, further important knowledge resulted from the surveys made west of the Rio Grande in 1849 by Lieutenant J. H. Simpson, and in the country east of that river, on the borders of New Mexico and Texas, by Captain R. B. Marcy. In the same year survey work was begun by Colonel J. E. Johnston which covered the great part of Texas south of the 34th parallel and west of longitude 96° west. The United States-Mexican Boundary Survey of 1849-56; the explorations of the Colorado River and plateau by Captain L. Sitgreaves and Lieutenant Derby in 1851; the exploration of the sources of the Red River by Captain R. B. Marcy in 1852, all these exploits added greatly to the geographical and geological knowledge of this region and were productive of numerous maps.[17]

Further north, the expedition of Captain Howard Stansbury, who was throughout assisted by Lieutenant J. W. Gunnison, resulted in the discovery of another route across the Rocky Mountains in 1849 and 1850. The report of the expedition was published by Stansbury at Philadelphia in 1852, as Exploration and Survey of the Valley of the Great Salt Lake of Utah; including a Reconnaissance of a New Route Through the Rocky Mountains. It was accompanied by two maps, one showing the routes from the Missouri River to the Great Salt Lake, and the other delineating Great Salt Lake and vicinity.[18]

## The Pacific Railroad Surveys

The phenomenal territorial expansion experienced by the United States during the years from 1846 through 1848, when Texas, California, and the Oregon Country became part of the Union and increased its area by some 1,204,897 square miles, made the problem of communication between East and West a most urgent one.

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[16]For a description of these maps, see Warren, op. cit., p. 43 ff.

[17]Ibid., p. 56 ff.

[18]Ibid., p. 57.

The only practical solution was, of course, a railroad to the Pacific, but the tremendous cost of this formidable task delayed action for several years. Finally, in 1853, Congress authorized the War Department to proceed with surveys for a railroad from the Mississippi River to the Pacific Ocean, and during the following seven years five routes were surveyed across the continent. The results of these memorable surveys have been recorded in thirteen quarto volumes.

One of the maps in these volumes is especially valuable today, because of its revelation of the state of knowledge existing just before the Civil War with respect to the topography and hydrography of the western United States. The map is dated 1857, and was compiled by Lieutenant G. K. Warren of the United States Army. It is entitled Map of the Territory of the United States from the Mississippi to the Pacific Ocean . . . , and is appended to Volume XI of the work cited in footnote 1. The historical value of the map is considerably enhanced, moreover, by the detailed and expert descriptive analysis which accompanies it. The analysis is by the map's compiler; from it we learn, for example, that "comparatively few points in the large area represented on the map have their latitudes and longitudes determined with precision;" that "surveys and explorations vary in accuracy by almost insensible degrees, from the determination of boundary lines to the crude information of the Indian or the still more vague representations of the imaginative adventurer;" and that "in some sections we possess no information, except from uncertain sources." In these parts "the rule was adopted to leave the map blank, or to faintly indicate such information as was probably correct." The map is plotted on the scale of 1:3,000,000, and measures 48 x 46 inches. It was revised and redrawn from 1865 to 1868 by Edward Freyhold, under the direction of the Chief of Engineers of the United States Army, and so reprinted and republished in New York, in 1868.[19]

No government survey of note seems to have been undertaken during the Civil War, but with the close of the war the work of surveying and mapping the western country was resumed with renewed vigor. Between 1867 and 1879 four surveying expeditions were put

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[19]See Phillips, List of Geographical Atlases, op. cit., title 917, where the full map title is given.

into the field, two by the War Department, and two by the Department of the Interior. These surveys have become known more popularly as the "Hayden, King, Powell, and Wheeler Surveys," thus named, respectively, after the geologists in charge of them.

## The Hayden, King, Powell, and Wheeler Surveys[20]

The first of these surveys was authorized by Congress in 1867. Its main purpose was "to examine and describe the geological structure, geographical condition, and natural resources of a belt of country extending from the one hundred and twentieth meridian eastward to the one hundred and fifth meridian of longitude, along the fortieth parallel of latitude. . . . ." Its director was Clarence King. In all, somewhat over 86,000 square miles of territory were examined. The results were published in seven volumes and an atlas,[21] from 1870 to 1880. The survey is more familiarly known as The Geological Exploration of the Fortieth Parallel.

The second of the surveys was also authorized by Congress in 1867. It was conducted under the authority of the Commissioner of the General Land Office and was placed under the direct charge of F. V. Hayden. The survey was eventually extended over all the territories, and work was done in Wyoming, Idaho, Montana, New Mexico, and Colorado. The total area embraced in systematic surveys comprised about one hundred thousand square miles. The results were published in a series of reports during the years from 1867 to 1883.

The third, or "geographical and geological survey of the Rocky Mountain region," though instituted by the Smithsonian Institution in 1867, was recognized by Congress in the following year and came eventually under the direction of the Secretary of the Interior. This survey covered in all about sixty-seven thousand square miles, embracing southern Wyoming, central and southern Utah, and adjacent portions of Nevada and Arizona. The results of the survey were not published in full. The only

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[20]On these surveys, see the "Catalogue and Index of the Publications of the Hayden, King, Powell, and Wheeler Surveys," which was prepared by L. F. Schmeckebier, and was published as U.S. Geological Survey Bulletin No. 222 (1904).

[21]Phillips, op. cit., title 1280.

printed documents available are two reports, dated 1877-78, by the director of the survey, J. W. Powell.

The fourth survey was under the direction of Lieutenant George M. Wheeler. It extended over the territory west of the one hundredth meridian, that is, the western parts of the Dakotas, Nebraska, Kansas, and Texas, and the Rocky Mountains and Pacific coast states. This survey covered the years from 1872 to 1879, and was primarily geographical or topographical in nature, although other scientific pursuits were also embraced. Its valuable results were published under various titles during the period from 1875 to 1889. The maps were collected into an atlas.[22]

Because some of the work of these surveys was done with varying methods and standards in areas that overlapped, Congress called upon the National Academy of Sciences for the formulation of a less wasteful plan to carry on these activities. The Academy accordingly submitted a report in 1878 recommending the termination of these conflicting surveys and their consolidation into a new and independent organization in the Department of the Interior to be known as the "United States Geological Survey." Congress acted upon these recommendations on March 3, 1879, and created what has since come to be the major land surveying and mapping service in the United States. The nature and functions of this as well as the other mapping services of the Federal government are described in the next section.

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[22] Ibid., title 1281.

# PART II

# CONTEMPORARY GOVERNMENT MAPS AND MAPPING SERVICES

## CHAPTER X

## THE MAPPING SERVICES OF THE UNITED STATES GOVERNMENT

The mapping services of the United States government are distributed among numerous departments, bureaus, and services. It is on the basis of relative emphasis, accorded to mapping activities by these agencies individually, that they have been listed and classified into three major groups, as follows:

List of United States Government Mapping Agencies

I. Primary Government Mapping Agencies:

1. Geological Survey (Department of the Interior)
2. Coast and Geodetic Survey (Department of Commerce)
3. Great Lakes Survey (War Department)
4. International Boundary Commission, United States, Alaska, and Canada (Department of State)

II. Secondary Government Mapping Agencies:

5. Bureau of Chemistry and Soils (Department of Agriculture)
6. Forest Service (Department of Agriculture)
7. Bureau of Public Roads (Department of Agriculture)
8. Soil Conservation Service (Department of Agriculture)
9. Federal Power Commission (Independent)
10. General Land Office (Department of the Interior)
11. Bureau of Indian Affairs (Department of the Interior)
12. Bureau of Reclamation (Department of the Interior)
13. Hydrographic Office (Navy Department)
14. Division of Topography (Post Office Department)
15. International Boundary Commission, United States and Mexico (State Department)
16. Corps of Engineers; U.S. Army (War Department)
17. Mississippi River Commission (War Department)

III. Government Agencies Indirectly Concerned with Mapping:

18. Bureau of Agricultural Economics (Department of Agriculture)

19. Bureau of Agricultural Engineering (Department of Agriculture)
20. Bureau of Air Commerce (Department of Commerce)
21. Bureau of the Census (Department of Commerce)
22. Bureau of Foreign and Domestic Commerce (Department of Commerce)
23. National Park Service (Department of the Interior)
24. Bureau of Aeronautics (Navy Department)
25. U.S. Army Air Corps (War Department)
26. Military Intelligence Division; General Staff (War Department)
27. Board of Surveys and Maps (Independent)

This grouping of the mapping agencies of the Federal government corresponds substantially to the rating given them in the recent "Report of the Committee on Mapping Services of the Federal Government," which is part of the Second Report of the Science Advisory Board for 1934-35, published in Washington, September 1, 1935. This mapping report is the result of the investigations conducted in 1934 by a committee of seven scientists appointed by the Science Advisory Board, at the behest of the director of the Federal budget. The committee was also asked to make recommendations respecting the feasibility of creating a consolidated Federal surveying and mapping agency. It is interesting to note that but one major recommendation was made by the committee in this sense, namely, that the Coast and Geodetic Survey; the Topographic Branch and the Division of Engraving and Printing of the Geological Survey; the United States Lake Survey; and the United States Section of the International Boundary Commission, United States, Alaska and Canada, be constituted a central mapping agency. No further consolidation was believed reasonable and practicable at the present time.

In fine, the object of the committee as carried out in the report was, first, to inquire what government services are presently engaged in surveying and mapping in either primary, secondary, or purely incidental capacity and, second, to make recommendations as to the possible and profitable consolidation of these services into a central mapping agency. The report has therefore much to say that is new and revealing with respect to the scope and nature of the mapping services of the Federal government. It has less to

say with regard to the resulting map publications as such; and does not, of course, deal with available map lists or catalogs. Inasmuch as the following pages are devoted to summary descriptions of the surveying and mapping functions of the various government services, the information made available by the report has proved uniquely valuable and has been extensively drawn upon. Descriptions of significant map publications and map series, as well as lists of certain historical maps have also been included in these pages. The sequence in which the mapping agencies are presented is identical with that of the above list.

## I. Primary Government Mapping Agencies

### UNITED STATES GEOLOGICAL SURVEY

Systematic and large-scale mapping activities of the Federal government may be said to date from the creation, in March 1879, of the United States Geological Survey. According to the organic act of Congress, the major functions of the Survey are the examination of the geologic structure, the mineral resources and natural products of the national domain, and the classification of the public lands. There was nothing in the legislation creating the Survey which authorized topographic mapping, and it was not until 1889 that funds were voted by Congress for this purpose.[1] But if topographic mapping was at first primarily undertaken by the Survey in order to provide base maps for geological surveys, it soon became apparent that these maps also served a very great variety of other needs. Indeed today less than 7 per cent of the topographic maps produced by the Geological Survey are specifically prepared to meet the needs of the Federal geologists.[2] The vast majority of these maps

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[1] "Report of the Committee on Mapping Services of the Federal Government," Second Report of the Science Advisory Board, September 1, 1934 to August 31, 1935 (Washington: Government Printing Office, September 1, 1935), p. 228.

[2] Monographic treatment of the early history of the Survey is available in the two following works. The first is entitled "The United States Geological Survey: Its Origin, Development, Organization, and Operation"; it forms U.S. Geological Survey Bulletin No. 227 (1904); the second is due to the Institute for Government Research; it is entitled The U.S. Geological Survey, Its History, Activities and Organization, and is issued as "Service Monograph of the United States Government, No. 1," (New York, 1918); this monograph is provided with a good classified bibliography.

published annually by the Survey are destined to supply the insistent demands of a non-geologic public, for the maps are of incalculable value to those engaged in railway and highway construction, irrigation projects, flood control, water supply and power development, mining operations, land classification, soil studies, Federal, state and municipal planning, the location of parks and of recreation centers, power transmission and pipe lines, sewer construction, and many other undertakings. The Geological Survey presents thus the anomalous situation of a bureau which has developed an originally subsidiary function into a major service concerned for the most part with broad public needs. It engages besides in a large amount of miscellaneous surveying and mapping, not only for its own several branches but also for other Federal agencies, as will be pointed out.

## The Topographic Mapping of the United States

The topographic mapping of the United States is intrusted to the Topographic Branch of the Geological Survey. According to the Survey's definition, the topographic map is "a representation on paper that is designed to portray certain selected features of a section of the earth's surface plotted on some form of projection and to a certain scale; it primarily depicts the relief of the country mapped, but shows also its drainage and cultural features, and delineates all features in true latitude and longitude, and therefore all parts in a rigidly correct relative position."[3] In fine, the topographic map is a relief map that not only depicts with accuracy the shape and altitude of land and water features by means of contours, but also shows the works of man, such as railroads, highways, buildings, etc., in their true relation to one another and to the natural features of an area. In general, a topographic map is essential to any problem dealing with the use of land. It is a basic map.

The topographic maps of the Survey are designed to constitute a topographic atlas of the whole of the United States, Alaska, and Hawaii. For the purpose of this atlas, the entire area of the United States is divided into several thousand small

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[3]For a complete treatment of these maps, see "Topographic Instructions of the U.S. Geological Survey," U.S. Geological Survey Bulletin, No. 788 (1928).

quadrangles, defined by meridians of longitude and parallels of latitude. The individual maps are projected to represent these quadrangle areas rather than political divisions, and each map is designated by the name of some prominent town or natural feature in the area mapped.

The scales on which these quadrangle maps are published are determined by the use to be made of the maps and by the nature of the particular territory to be mapped. The scales most commonly employed are those of 1:62,500, 1:31,680, and 1:125,000. The scale of 1:31,680 instead of 1:31,250 (half of 1:62,500) is used because all the township plats of the public land surveys of the General Land Office have been made on the 1:31,680 scale. For certain areas of particular importance, special large-scale maps are prepared.

## Present Status of Topographic Mapping in the United States

Only about 48 per cent of the area of the United States has thus far been mapped topographically, and of this percentage only about one-half is mapped adequately according to modern needs and standards. Connecticut, Delaware, the District of Columbia, Maryland, Massachusetts, New Jersey, New York, Ohio, Rhode Island, and West Virginia are completely mapped. Several maps of the coal regions of Kentucky and of West Virginia, the oil fields of Oklahoma and Texas, and a number of quadrangle sheets of the mining areas of Colorado, Idaho, Nevada, and Montana, have recently been published or are now in process of publication by the Survey.

The pressing need for basic maps has led the Survey to the compilation and publication of an increasing number of planimetric maps (i.e., maps compiled from aerial photographs and showing cultural features but no contours), usually on the scale of 1:31,680, with each map sheet representing one-quarter of the standard sheet on the 1:62,500 scale. Over two hundred such maps have been published of Michigan and Louisiana.[4] Because of the absence of contours, these maps must necessarily be considered little more than welcome emergency additions to the regular series.

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[4]See The American Yearbook, 1935 (New York, 1936), p. 264.

## Index Map Showing Status of Topographic Mapping in the United States

An index map on the scale of 1:11,600,000 showing the present status of topographic mapping in the United States may be found facing page 76 of the National Resources Board Report, published on December 1, 1934 by the Superintendent of Documents, Washington, D.C. It has been pointed out that this is the first official map ever published showing adequately the status of topographic mapping in the United States (i.e., expressed in terms of equality and differentiated according to scale).[5] The last of a series of official index maps differentiating the surveyed areas according to scales is the map accompanying the 45 Annual Report of the Director of the U.S. Geological Survey for 1923-24, Plate I. Subsequent index maps published in the annual reports of the Survey do not differentiate according to scales.* A somewhat refined version of the index map included in the National Resources Board's report is published on the scale of 1:14,000,000, with additional insets showing the status of mapping in Alaska, and Hawaii, in the Geographical Review for April, 1935.

## General or Compiled Maps: State Maps; The International Map of the World; etc.

Closely related to the topographic maps are the general or compiled maps of the Geological Survey. These maps are usually produced on small scales and without representation of relief.

The most prominent among these maps are the state base maps. Such maps have now been compiled for all the states, except California (now partly completed), on the scale of 1:500,000. They show cities, towns, railroads, state, county and reservation boundaries; township lines of public land surveys, and streams. The earlier maps of this series were printed in black, but the more recent issues are in two colors. Besides their general use, the maps are extensively employed as bases on which to overprint colors, and special information relating to geology, oil, gas, and coal fields, power transmission lines, national forests, and other features.

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[5] Wolfgang L. G. Joerg, "Summary of Recent Reports on Natural Resources," Second Report of the Science Advisory Board (Washington: Government Printing Office, 1934), p. 421.

*See also the topographic status map cited on p. 220.

It is interesting to note that the Lambert conformal conic projection[6] which is used with the present two-color maps makes it possible to fit the maps of adjoining states in such a way as to form a huge map of the entire country.

The series of state maps is based very largely on the needs of the International Map of the World and is, in a sense, a by-product of the international series. This series of maps is being compiled by agreement among most of the nations of the world. It is being issued on the uniform scale of 1:1,000,000, or approximately sixteen miles to the inch, with each map-sheet covering an area of four degrees of latitude by six degrees of longitude. The maps conform to standard international specifications and may be read and understood regardless of language differences. When complete, the map will comprise approximately fifteen hundred sheets and will cover the land area of the entire world. Only four map sheets of this series have been published thus far for the United States.[7]

The Survey has also published a number of general, shaded relief maps. Such maps have been issued for Arizona (1:500,000), Idaho (1:760,320), Kentucky (1:500,000), Ohio (1:380,160), the United States (1:3,168,000), and Alaska (1:2,500,000). By this time similar maps have probably been published for Colorado, New England, New Mexico, New York, Pennsylvania, West Virginia, and Wyoming.[8]

### The Work of the Geologic Branch of the Survey: The Geologic Atlas of the United States

The Geologic Branch of the Survey is intrusted with the study and mapping of the mineral resources of the United States. The results are published as Bulletins, Professional Papers, and Monographs, and in the form of "geologic folios," which are part of the Geologic Atlas of the United States.

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[6] On map projections in general, see Charles H. Deetz and Oscar S. Adams, Elements of Map Projection with Application to Map and Chart Construction (U.S. Coast and Geodetic Survey; "Special Publication," No. 68. Washington: Government Printing Office, 1931).

[7] For further details on this map, see the circular: International Map of the World, which is obtainable from the Director of the U.S. Geological Survey.

[8] U.S. Geological Survey Bulletin, No. 788 (1928), p. 361.

Generally speaking, each geologic folio relates to a single quadrangle, that term having the same meaning as when applied to the topographic map, though some folios cover two or more quadrangles. Each geologic folio is named after some city, town, or other prominent landmark within the quadrangle, and each folio includes maps showing topography, geology, underground structure, mineral deposits, and economic geology, including oil, gas, and artesian water, if conditions warrant their mapping.

The scales of these maps agree with those most commonly employed for topographic maps, viz., 1:62,500, 1:31,680, and 1:125,000. According as one or the other of these scales is used the survey is said to be "reconnaissance," "detailed," or "exploratory." All of the 226 geologic folios issued thus far are, with a few exceptions, uniformly 18 1/2 by 22 inches in size. Note should, however, be made of the fact that geologic maps of Wyoming (1925), of Oklahoma (1926), and of Mexico (1928), have been published by the Survey as unnumbered parts of the Geologic Atlas.

### The Water Resources Branch; the Conservation Branch; and the Alaskan Branch of the U.S. Geological Survey

These are the three remaining branches of the Survey. The first, the Water Resources Branch, is concerned with the determination of the water resources of the country, above and below ground. Each year surveys are made of selected areas where problems of water supply are urgent, and the results generally find expression in the so-called "Water-Supply Papers," many of which are supplemented with river profile and strip maps.

The Conservation Branch of the Survey classifies, appraises, and aids in the administration of the public domain. Its river profile, dam site and reservoir surveys are publicized either in special papers or through personal consultation.

The Alaskan Branch performs in Alaska practically all the functions of the other branches of the Geological Survey.* Over 45 per cent of the total area of that country has now been covered geologically, and about 48 per cent topographically. The results of these surveys and investigations have been made available through numerous published reports and maps.

It should be emphasized, of course, that the Geological Survey is also called upon to do a considerable amount of surveying

*See U.S. Geological Survey, Professional Paper No. 45 (1906); it includes a bibliography on Alaskan geography and geology.

and mapping for other Federal bureaus and offices, as will be pointed out in the succeeding pages.

### Catalog of Geological Survey Publications

A complete list of the Geological Survey publications, except its topographic maps, is available from the Director of the Survey in the form of a comprehensive catalog, entitled Publications of the U.S. Geological Survey. It is revised at intervals of a year or two. For bibliographical indications respecting the Survey's topographic maps, see under U.S. Geological Survey, Department of the Interior, in the appended reference list of United States government maps and map sources.

## UNITED STATES COAST AND GEODETIC SURVEY

The U.S. Coast and Geodetic Survey,[9] in the Department of Commerce, has much in common with the Topographic Branch of the Geological Survey. The field of endeavor of both is scientific and nation-wide; each is primarily engaged in field service; and the results of the work performed by each are largely published in the form of maps. In point of size and breadth of activities the Coast and Geodetic Survey is the major surveying and mapping agency of the Federal government.

The Coast Survey is also one of the oldest government mapping agencies, for its date of creation by act of Congress reaches back to February, 1807. The geodetic function of the Survey did not come into prominence, however, until after the Civil War when Congress authorized the geodetic connection between the Atlantic and Pacific seaboards of the United States. The result of this undertaking was the great transcontinental arc of triangulation along the 39th parallel of latitude--one of the most famous arcs in geodetic history. This achievement brought about the immediate recognition of geodetic operations as a major function of the Coast Survey, and in 1878, its title was officially lengthened to the present one of "Coast and Geodetic Survey."

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[9]See also the U.S. Coast and Geodetic Survey's "Special Publication No. 23," entitled The United States Coast and Geodetic Survey, Its Work, Methods, and Organization (Washington: Government Printing Office, 1929). Pp. 117; illus.

Major Functions

The present major functions of the Coast and Geodetic Survey include the following:

(1) Surveying the coastal waters of the United States and its territorial possessions and reproducing the results on marine charts;

(2) Conducting the geodetic control surveys which form the essential basis of all accurate charting and mapping activities by providing the horizontal position and the elevation above or below sea level of a large number of control points;

(3) Making such topographic surveys of a narrow strip along the coast as may be essential to include prominent landmarks helpful in guiding the navigator;

(4) Conducting the tidal and current surveys necessary to establish datum planes on which all topographic surveys on land and all hydrographic surveys at sea must be based, and to make possible the accurate prediction of the rise and fall of the tides and the times and velocities of currents;

(5) Making magnetic observations throughout the country in order to establish the amount of magnetic variation, knowledge of which is essential to the use of the magnetic compass for navigation and surveying;

(6) Preparing and publishing coast pilots, tide tables, current tables and other information essential to safe navigation of the sea and to certain operations in surveying on land and water.[10]

In addition to these major functions the Coast and Geodetic Survey carries on seismological investigations formerly under the control of the Weather Bureau, and produces air navigation maps for use of the Aeronautics Branch of the Department of Commerce. It also performs services in aid of scientific research, certain classes of litigation, and engineering projects and industrial enterprises. With the exception of cadastral work the Coast and Geodetic Survey engages to some extent in all the major surveying operations involved in mapping on land and sea and from the air. No other government mapping agency has such wide experience.

The Chart Publications of the U.S. Coast and Geodetic Survey

The principal object of the hydrographic work, which constitutes the Survey's major activity, is to secure information concerning water areas for use in compiling nautical charts and

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[10]"Report of the Committee on Mapping Services," op. cit., p. 193.

Coast Pilots. A brief description of the nature and scope of these publications is given below.

## Nautical Charts

These charts are published primarily for navigational use. Their purpose is to portray the water areas rather than the land. They are not intended for use as topographic maps, which are published by the U.S. Geological Survey, and for this reason land features are not shown in great detail. Usually there is only shown a strip of topography extending inland for about three miles from the shore line, back of which only important landmarks visible at sea are shown, other features being generalized or omitted. There are exceptions to this rule, especially on some of the earlier published charts, on which the land features are reproduced with minute accuracy.

The charts are constructed on scales appropriate to different uses. On the Atlantic coast, for example, four distinct series of charts are differentiated. In three of these the charts are located so that each chart overlaps the edges of the adjacent charts in the same series. In this way the entire coast is charted on three different scales.

In the first series, known as "Sailing Charts," the scale is small and varies from 1:600,000 to 1:4,500,000. These charts are intended to fix the navigator's position as he approaches the coast from the open ocean, or when he is sailing between distant ports along the same coast. They show offshore soundings, the principal lights and outer buoys, and natural landmarks visible at considerable distances.

Charts of the second series are called "General Charts of the Coast." Their scale varies from 1:180,000 to 1:400,000, and each chart covers a more limited area. They are designed for coastwise navigation, when a vessel's course lies within sight of land, with her position fixed by landmarks, lights, outer buoys, and characteristic soundings.

Charts in the third series, called "Coast Charts," are on scales varying from 1:80,000 to 1:100,000. Such charts are necessarily confined to short stretches of coast. They are prepared for close coastwise navigation when a vessel's course carries her inside outlying reefs and shoals. These charts are best suited

for entering bays and the larger harbors, and for navigating the large inland waterways.

The fourth series consists of "Harbor Charts." These are the largest-scale charts of all; their scales vary from 1:5,000 to 1:40,000. They are intended to meet the needs of local navigation and are, in general, constructed on different scales so that adjoining map sheets do not fit together. These charts exhibit much fuller hydrographic and topographic detail than the charts of the other three series, and therefore serve a variety of purposes additional to those of navigation.

### Intracoastal Waterways (Inside Route) Charts

These charts embrace the inside routes from New York to Norfolk, and from Norfolk to Key West. They are mostly on scales of 1:40,000 and 1:80,000. They have been added to the Survey's chart publications in recent years.

### United States Coast and Intracoastal Waterways Pilots

The Coast Pilots published by the Coast and Geodetic Survey in book form contain information required by the navigator that cannot be shown conveniently on nautical charts. Each Coast Pilot covers a certain section of the coast and gives general information concerning such subjects as weather conditions and radio service, detailed information relative to the coast and harbors, port information, and sailing directions for coasting and entering harbors. Such Pilots have been issued for sections of the Atlantic coast, the Gulf coast, the Intracoastal Waterways, the West Indies, the Pacific coast, Alaska, the Hawaiian Islands, and the Philippine Islands. Similar publications known as Inside Route Pilots, describe and give directions for use of the inland waterways along the Atlantic and Gulf coasts of the United States. All these guides are kept up to date by means of annual supplements, and new editions are issued at intervals of from three to six years.

### Current Diagrams and Charts

The results of the tide and current work of the U.S. Coast and Geodetic Survey are published in the form of tide and current tables, current diagrams and charts, tidal bench marks, harbor

and miscellaneous publications. The current tables are issued in advance, annually. They are published in two volumes, entitled respectively: Current Tables, Atlantic Coast, North America, and Current Tables, Pacific Coast, North America and Phillippine Islands. Current diagrams for a number of the more important waterways are included in these current tables. One of the current diagrams, namely that of Chesapeake Bay, has been reproduced on a large scale and published separately. A number of "Tidal Current Charts," consisting of sets of twelve charts to each water area covered, have been issued by the Survey since 1930. The charts are printed in colors and depict for each tidal hour the direction and velocity of the current that may be expected throughout the entire harbor. They are useful not alone to the navigator, but also to the engineer and the scientist confronted with problems of the circulation of surface waters. Such charts have been issued for the following harbors: Boston Harbor (1931); New York Harbor (1932); San Francisco Harbor (1931); and Long Island Sound and Block Island Sound (1934).

It may be noted that the tide and current tables, and the current diagrams and charts are sold by the Director of the Coast and Geodetic Survey, and field agents, and that the remaining tide and current publications are obtainable from the Superintendent of Documents, Government Printing Office, Washington, D.C.

## Other Government Agencies That Issue Nautical Charts

The Hydrographic Office of the Navy Department, and the various Corps of Engineers divisions of the War Department, also issue nautical charts; but they cover different areas and will be described in subsequent sections.

## Airway Maps

The task of charting the civil airways of the United States was intrusted to the Coast and Geodetic Survey by the Air Commerce Act of 1926. The first airway maps prepared by the Survey under this Act were called "strip" airway maps. These cover a strip of territory about eighty miles wide (about ten inches in width) along established airways. This series of maps will perhaps become obsolete when in the course of the present year the Coast and Geodetic Survey will complete its newer and more

comprehensive "sectional" airway maps which have been in progress since 1932.

About two-thirds of the total of 87 "sectional" airway maps required to cover the entire United States have already been issued.* Practically the whole country east of the 102d meridian is now covered, and of the area to the west of that meridian essentially only the Great Basin and central Rocky Mountain sheets await completion. The compilation of the remaining sheets is finished so that the end of this major undertaking is at hand. The maps are on the scale of 1:500,000, with each map sheet representing an area of two degrees of latitude by six degrees of longitude, and measuring 20 x 42 inches in size. This will be the first sheet-map of the United States on a relatively large scale showing relief, and but for the limitation of undifferentiated elevations below a thousand feet, the map could readily fulfill for the area of the United States the functions of the International Map of the World on the 1:1,000,000 scale.[11]

The base of both the strip and the sectional maps is an accurate chart of the territory with the political boundaries, rivers and lakes, cities and towns, railroads, Federal and state highways, and elevations. These features are set out in black and color, and superimposed upon them are the items of particular interest to airmen, such as airways, airports, auxiliary and other landing fields, seaplane anchorages, revolving and flashing beacon lights, lighthouses, radio communication stations, radio range beacons, high tension lines, as well as magnetic variations and compass roses. Names of post offices are indicated in airway maps even for towns of small population.

The most recent development in airway maps by the Coast and Geodetic Survey has to do with the preparation of small-scale maps for high-speed flying. These maps are on the scale of 1:1,000,000; they are reduced reproductions of several map-sheets of the "sectional" airway map just noted, and cover nearly six times as much ground as the latter. Certain details, such as the names of the smaller towns and the less important highways, are naturally omitted from these maps in order to avoid congestion.

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[11]Mr. Joerg points out (see American Yearbook, 1935, p. 264) that the prospects of completing the country's share of the map appear increasingly unfavorable, only four of the forty-three sheets required having been published during the past twenty-four years.) *Note: The map is now complete.

Only seventeen sheets on this scale will be required to cover the whole country. Two sheets encompassing the belt between the 38th and 44th parallels and extending from Portland, Maine, to St. Louis have been published under the title of "Regional Aeronautical Chart." Each sheet appears in an extra edition containing on the back a night-flying chart of the same area.

### Notice of New Airway Maps

Upon request to the Director, Coast and Geodetic Survey, Washington, D.C., persons interested will be supplied with a list of available airway maps, and have their names added to mailing list No. 109-R to receive prompt notice of the issuance of new airway maps.

### Other Government Agencies Issuing Air Maps

The U.S. Army Air Corps and the Hydrographic Office in the Navy Department also have produced airway maps. The former's "strip" maps serve primarily military needs and are obtainable only through the Director of the Coast and Geodetic Survey and the Survey's field stations. The Hydrographic Office's air maps are known as "Aviation Charts"; they are dealt with elsewhere.

### The Survey's Map Reproduction Facilities

For the reproduction of its charts, air navigation maps and other products, the Coast and Geodetic Survey maintains a large map reproduction plant equipped with several printing presses and also with a modern camera taking a negative 50" x 50" and capable of photographing the largest charts. Some 300,000 individual copies of charts and airway maps are thus published annually by the Survey.

### Catalog and List of Coast and Geodetic Survey Publications

For its chart and map publications there is issued annually by the Survey a catalog of about sixty pages, entitled: Catalog of U.S. Coast and Geodetic Survey Nautical Charts, Coast Pilots, Tide Tables, Current Tables, Tidal Current Charts, Airway Maps. It lists, with prices, the nautical publications of the United States and its possessions; and also the airway maps published by the Department of Commerce and the Army Air Corps.

This catalog and the publications listed in it, unless otherwise stated, are issued by the Director of the Coast and Geodetic Survey, Washington, D.C., and by the Survey's authorized sales agents. For a list of the numerous other publications of the Survey consult the annual List of Publications of the Department of Commerce. This list and its contents, unless otherwise indicated, are available only from the Superintendent of Documents, Government Printing Office, Washington, D.C.

GREAT LAKES SURVEY

The Great Lakes Survey, in the War Department, is another primary mapping agency of the Federal government. The area covered by the Survey includes the Great Lakes region and the St. Lawrence river basin. It approximates some 157,000 square miles within the United States, covering all of the state of Michigan, and parts of Minnesota, Wisconsin, Indiana, Ohio, Pennsylvania, New York, and Vermont.

Attempts to survey the Great Lakes were made by engineer officers of the United States Army as early as 1816. But it was not until 1841 when the "hydrographic work of the northern and northwestern lakes of the United States" was inaugurated by Congress that systematic surveys of the Great Lakes were begun. This work was not at once assigned, however, to the Corps of Engineers, but to a special mapping unit--the Corps of Topographical Engineers--which functioned as an independent bureau in the War Department separate and distinct from the Corps of Engineers. The survey of the Great Lakes was inherited by the Corps of Engineers by way of absorption, more than twenty years later, of the Corps of Topographical Engineers.[12]

The United States Lake Survey is itself an offshoot of the Corps of Engineers of the War Department. It has its headquarters at Detroit, Michigan, and is responsible to the Chief of Engineers, at Washington. Its major functions are the charting of the waters of the Great Lakes and their connecting and outflow waters, Lake Champlain, the natural waterways of the New York State Canal System, the Lake of the Woods and other navigable boundary waters; and the furnishing of reliable information concerning these waters and obstruction or changes therein affecting

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[12]"Report of the Committee on Mapping Services," op. cit., p. 279.

navigation. The Survey is likewise charged with the investigation of changes of lake levels and the causes producing them; the measurement of flow through connecting and outlet rivers and investigation of the laws governing such flow; and also the study of the effects of river changes on navigation, and of proposed engineering structures on river and lake levels.

### Nature and Extent of Surveying and Mapping Activities

The hydrographic work of the Lake Survey is in principle limited to the United States waters of the lakes, the Hydrographic Office of the Navy Department having jurisdiction over the production of charts covering Canadian waters; but for special reasons the Lake Survey may extend its operations locally into Canadian territory. The survey work consists primarily in the execution of detailed hydrographic surveys of United States waters to the plane of thirty feet below the adopted low-water datum of the open lakes, and twenty-five feet below the corresponding datum in channels of connecting rivers; and in sounding the deeper parts of all the Great Lakes on lines about three miles apart. It has been reported by the Survey that with the exception of work on Rainy Lake (which will perhaps be completed in 1936) all original surveys have been consummated, and that surveys in the future will be of a revisionary nature only.[13]

### Chart Publications of the Lake Survey

The results of the surveys are incorporated in a large series of hydrographic charts prepared and issued at the Detroit office of the Lake Survey. All the charts are produced on the polyconic projection. They depict the hydrography of the water areas, the topography of a narrow strip of land of continuous shores and islands, and mark the docks and structures and landmarks visible from the lakes and channels. Various scales are employed to serve the purposes of different classes of charts. Thus the small scale of the general lake chart is suitable for the needs of open-lake navigation; the medium scale of coast, river and sectional charts afford greater detail for close navigation; and the largest scale charts permit the showing of detail

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[13] Ibid., p. 277.

pertinent to restricted navigation in harbors and confined localities. A total of 125 such charts are kept in circulation.

### Information Service

The Lake Survey also maintains an important navigation information service. In connection with the latter it issues a Bulletin which supplements the charts and contains detailed information with respect to harbors, shore lines, shoals, magnetic variations and other factors influencing navigation. This bulletin is revised and published annually, in April, and is supplemented by monthly issues during the navigation season. The Survey also publishes a monthly notice of lake stages and on request furnishes other information to navigators.

### Catalog of Publications

A comprehensive list, entitled: Catalogue of Charts of the Great Lakes, Lake Champlain, New York Canals, Lake of the Woods, completely covers the publications of the Great Lakes Survey. The catalog is amply provided with index maps and diagrams and is issued annually. Charts, bulletin, and catalog are all issued and distributed by the U.S. Lake Survey Office, at Detroit; but they are also obtainable from the local U.S. Engineer Offices at Albany and Buffalo, New York, and the U.S. Canal Office at Sault Ste. Marie, Michigan.

### Inland Navigation Charts Issued by Other Government Agencies

For river and harbor charts issued by other Federal mapping agencies, see under Coast and Geodetic Survey, Department of Commerce, and also under the War Department's Corps of Engineers divisions, viz., the North and South Atlantic Divisions, the Ohio River Division, the Upper Mississippi Valley Division, the Mississippi River Commission, the Gulf of Mexico Division, the Missouri River Division, and the North and South Pacific Divisions.

## INTERNATIONAL BOUNDARY COMMISSION, UNITED STATES, ALASKA, AND CANADA: U.S. SECTION

The United States section of the International Boundary Commission, in the Department of State, completes the number of Federal government agencies that have mapping as their primary function. A description of government agencies engaged in mapping as a subsidiary function appears in the next section.

The international boundary line between the United States and Canada and between Alaska and Canada has been laid down, surveyed, monumented and mapped under provisions of the treaties of 1903, 1906, 1908, and 1910. It should be noted, however, that an international commission as such was not set up by any of these treaties, and that the name "International Boundary Commission" applies only to the extent that it is the name which has been given to the personnel group in each country who assist the two Commissioners jointly in carrying out the provisions of the boundary treaties.[14]

The cartographic work of the Commission has been practically completed, and it appears that the present major function of the International Boundary Commission is to maintain in proper repair a boundary already surveyed. Thus the only surveying now required is that incidental to boundary maintenance work, including revision of boundary maps for important changes in culture, and the more accurate determination of geodetic positions for certain boundary nomuments established when surveying methods were less perfected than now. This latter task will be accomplished in the near future.[15] A list of the maps that have been published by the American section of the Commission has been kindly made available by its Secretary, Mr. Edgar A. Klapp. It has been reproduced in the appended reference list of United States government maps and map sources, under the main heading of "State Department."

A corresponding description of the mapping activities of United States section of the International Boundary Commission, United States and Mexico, will be found in the next section.

## II. Secondary Mapping Agencies of the Federal Government

In this group are comprised government agencies the major surveying and mapping activities of which, while relatively extensive, constitute a subsidiary service to the discharge of major functions. A brief description of the major functions and mapping activities of these agencies follows.

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[14] Ibid., p. 295.

[15] Ibid., p. 294.

BUREAU OF CHEMISTRY AND SOILS

The major functions of the Bureau of Chemistry and Soils, in the Department of Agriculture, are the definition of soil types or units, the identification of these units on the ground, the mapping of their distribution throughout the United States and its possessions, and the determination of their significance in land use.[16]

Nature and Extent of Mapping Activities

The surveying activities of the bureau are designed to give a base map showing features useful to soil experts in locating boundaries of different soil types. The surveying methods are either of the detailed or of the reconnaissance type. Contours are not essential.

Detailed surveys and maps have thus far been completed for about 1,500,000 square miles, or about one-half of the land area in the United States. The maps are usually laid out on the scale of 1 inch to the mile (some recent maps are on the scale of 2 inches to the mile; they correspond either to the size of a county or to some definite area. A large map of this nature, accompanied by an individual soil report, has been published by the bureau for each area or county surveyed. A complete listing may be found in Price List 46 which is available free from the Superintendent of Documents. An index map showing the present status of the detailed and reconnaissance type of soil surveys executed in the United States, and also a "List of Detailed Projects Covered by the Soil Survey," are included in Part III of the Atlas of American Agriculture. This part of the atlas is entitled "Soils of the United States"; it was prepared by the late Curtis F. Marbut and associates of the Bureau of Chemistry and Soils, and published by the United States Government Printing Office in July, 1935. This work is considered further in the next pages.

Soil Classification Maps

Soil surveys not only provide practical working maps and handbooks that are of great assistance to the farmer in planning the best use of his soil, they also afford an inventory of National soil resources that is of immediate value to government

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[16] Ibid., p. 182.

policy. It was, for example, on the basis of information of soil characteristics derived from soil reports and soil maps that a classification of the soils of the United States was recently made under the direction of Dr. C. F. Marbut, with the cooperation of the Bureau of Chemistry and Soils, the Division of Land Economics of the Bureau of Agricultural Economics, and the State Agricultural Colleges and Experiment Stations.[17] The soils were grouped into productivity units, or units in which the soils have approximately uniform inherent productive capacity. The groups were then arranged in the order of their inherent productivity as determined from consideration of the principal physical conditions influencing productivity, such as soil type, topographical relief, rainfall and temperature. Each group was then rated by giving it an index figure designating its productivity for each of a series of crops. A rough example of the map embodying the results of this classification is afforded by the soil productivity map of New York state. It is included in the work entitled: State Planning for New York: Summary Report of Progress. The report was issued by the New York State Planning Board, Albany, New York, in January, 1935.

However, the most thorough as well as comprehensive and elaborate attempt at soil classification yet made in the United States is that embodied in the above mentioned work by C. F. Marbut, entitled Soils of the United States. Soil surveying was begun in the United States in 1899. From the beginning the work was done in great detail, though the line of approach was primarily agricultural, and each area was dealt with as a unit in itself. Similarly one-sided were the early attempts to define soil units, for these were largely based on the single criteria of surface soil texture to the usual depth of plowing. After a few years, however, it became apparent that it would be most advantageous to determine the relationships of the soils, isolated, defined, and mapped, in all projects throughout the country. The successive steps in the evolution of the Soil Survey from these simple beginnings to its present status as an institution concerned with all the characteristics of the soil units throughout the United States, not only to themselves but to the several factors of the

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[17] See Wolfgang L. G. Joerg, "Summary of Recent Reports on Natural Resources," Second Report of the Science Advisory Board (Washington: Government Printing Office, 1934), p. 405.

environment in which they were developed, have been briefly outlined in the text of this great work by Mr. Marbut and associates.

The magnificent Soil Map of the United States, which accompanies this work represents the results of the interpretation and systematization of all the data accumulated in the course of some 35 years of soil research. The map is on the scale of 1:2,500,000 (approximately 40 miles to the inch). It is in twelve sections and makes use of no less than 243 colored symbols to denote the different soil types represented. A small-scale inset-map indicates the degree of reliability of the individual map data. One section of the map is devoted to a complete list of soil legends.

Mention should perhaps be made of the fact that in the mountainous parts of the country, in the deserts of the Great Basin region, and in the western part of the Great Plains, large areas have not yet been mapped. These regions are therefore left blank on the soil map.

Also included in the work are the following three maps on the scale of 1:8,000,000:

A map showing the "distribution of the great soil groups (soil provinces)," of the United States. This map depicts the fifteen major soil-texture groups of the United States. The second map represents the "distribution of parent materials of soils classified according to process of accumulation." It shows the approximate distribution of the different kinds of materials from which the soils of the United States were developed. The third map depicts the "distribution of soils without normal profiles." It displays the areas in which soils without normal regional profiles are dominant rather than exclusive. Finally, there is exhibited a colored soil map on the scale of one inch to the mile, of Clark County, Georgia.

This monumental work on the soils of the United States may be obtained from the Superintendent of Documents, Washington, D.C., at the price of five dollars.

FOREST SERVICE

The major functions of the Forest Service, in the Department of Agriculture, are the conservation, administration and development of the forest resources of the nation. For the proper discharge of these functions the Service undertakes a large amount of surveying and mapping.

## Surveying and Mapping Activities[18]

The mapping activities of the Forest Service may be grouped under five heads: (a) Cadastral surveys of homestead entries, forest boundaries, lands approved for purchase, rights of way and administrative sites are performed. (b) Where no prospect of early mapping by the Geological Survey or other government agency exists and maps are urgently needed for fire-control, timber reconnaissance and other activities, planimetric surveys without relief on scales of two miles or four miles to the inch are made for considerable areas. An appreciable amount of aerial photographic equipment is possessed by the Service and is used extensively to secure aerial photographs for mapping purposes. (c) In the absence of standard Geological Survey topographic quadrangles, contour maps for fire control and timber cruising have been prepared for areas aggregating some thousands of square miles. Relatively cheap reconnaissance methods are employed in some of this work; elsewhere methods are said to be similar to those employed by the Geological Survey. (d) Contour maps of recreational areas (average of less than a thousand acres per annum) are prepared on a scale of one inch to four hundred feet with contour intervals ordinarily five or ten feet. Special surveys may have contour intervals as small as one foot or two feet. (e) Some 25 planimetric maps of national forests are compiled and published annually (about 185 such maps have been issued to date) on scales of four miles to the inch and two miles to the inch, rarely one mile to the inch, from data made available by federal, state, and county agencies supplemented by data secured by the Forest Service.

Considerable mapping is performed for the Forest Service by the Geological Survey and the General Land Office. The Forest Service maintains no map reproduction plant, except for making blueprints, photostats and similar reproductions. Most of its maps are reproduced by the Division of Engraving and Printing of the Geological Survey, some by the Engineer Reproduction Plant, at Washington, and some by commercial firms. A list of all the Forest Service's publications that may be purchased is printed in Price List 43, which is obtainable free from the Superintendent of Documents, Washington, D.C.

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[18] Ibid., p. 186.

BUREAU OF PUBLIC ROADS

The major functions of the Bureau of Public Roads, in the Department of Agriculture, are the administration of road construction work under the Federal Highway Act and related acts, and the conduct of research in the fields of highway design and highway economics. As an aid in the proper performance of these functions the Bureau examines and passes on surveys made by the State Highway Commissions for Federal aid construction projects; performs miscellaneous surveying work for road construction projects in Federal reservations, including national parks and national forests; collects certain cartographic data and compiles and publishes many thousands of road maps annually.[19] Since a large portion of the Bureau's work is done cooperatively with State Highway departments, contact with the latter is maintained through a regional office at San Francisco, twelve district offices, and state representatives.

### Nature and Extent of Surveying and Mapping Activities

The miscellaneous surveying performed by the Bureau in connection with the preparation of plans, specifications and estimates for highway construction projects in Federal reservations, and the examination of surveys made under the direction of State Highway Commissions, constitutes the major surveying activity of the Bureau. These surveys are not utilized, however, for the making of ordinary maps, for the mapping activities of the Bureau are limited to compiling and drafting of maps showing the progress of construction on the Federal highway system which, according to law, must be issued annually, and certain other maps noted below.

The data to be depicted on maps showing progress of construction are plotted on available base maps varying in scale from the standard Geological Survey topographic quadrangle to the Geological Survey state base maps on the scale of 1:500,000. The compiled maps are then published as a series of 112 sheets, showing the numbered routes of the Federal highway system on a scale of 1:500,000 for all states east of the Rocky Mountains, and 1:760,320 for states farther west. Annual editions of these maps are issued, with amendments to date.

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[19] Ibid., p. 181.

In addition the Bureau publishes an atlas consisting of eighteen maps, 22 x 23 inches in size, the scale varying with the number and size of states shown on each sheet, but all compiled on the General Land Office base map having a scale of 1:2,344,320.

The Bureau similarly issues an extended series of small-scale maps showing densities of traffic flow on Federal highways, and the classification of such highways according to density of traffic flow.

The Bureau is also cooperating with the Geological Survey in the preparation of a general transportation map of the United States. The map is expected to comprise 439 sheets and is to be issued in state units. It is to be plotted on the scale of 1:250,000, except that for congested areas the scales of 1:62,500 and 1:31,250 are to be employed. Two sheets each have already been published of Maine and Florida, and eight sheets of Iowa. The main purpose of the map is, of course, to give detailed road information; but the map is also of general geographical interest because of the relatively large-scale representation of the other features shown, although some of these, particularly drainage, seem merely enlarged from the Geological Survey's state base maps in 1:500,000.[20]

Strip maps for the projects of an Inter-American highway have been made by the Bureau on the scale of 1:48,000 and reproduced as blueprints and black-line tracings.

It may finally be noted that the Bureau does not possess map reproduction equipment of its own, and has its maps reproduced by photolithography in the reproduction plant of the Geological Survey and in the Engineer Reproduction Plant of the Corps of Engineers, at Washington. Available map publications of the Bureau are obtainable from the Superintendent of Documents, Washington, D.C., and may be found listed in the current editions of Price List 53, obtainable from the same source.

SOIL CONSERVATION SERVICE

The Soil Conservation Service, in the Department of Agriculture, is an outgrowth of the Soil Erosion Service, a temporary agency established in the Department of the Interior, in October 1933, under authority of the National Industrial Recovery Act. The Soil Erosion Service was transferred to the Department of

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[20] American Yearbook, 1935, p. 265.

Agriculture on March 25, 1935, and continued there under the present title of Soil Conservation Service.[21]

The major functions of the Service are the control of soil erosion, the stabilization of watersheds and the preparation of detailed and comprehensive land-use plans. An important related field of investigation involves reconnaissance and detailed surveys to determine the extent of sedimentation in reservoirs, streams, channels, and irrigation systems due to excessive erosion in contributing watersheds. A complete topographical survey of the inundated area at Boulder Dam is included in the scope of sedimentation studies. In all this work the Service has need for large-scale maps displaying details of ground cover and erosion, though they need not be of great accuracy. Aerial photographs, both individual and combined in mosaics, have been found best adapted to the needs of the Service, although many large-scale rough diagrammatic sketch maps and a few large-scale contour maps are made. For part of the Indian Reservation a small-scale map is being prepared from aerial photographs by a commercial firm under contract.[22]

### Nature and Extent of Mapping Activities

The Service does not itself engage in ordinary mapping activities. That part of its field work most closely related to mapping consists chiefly in classifying detailed land areas according to degrees of slope, soil types and other factors. In this work the individual farm is often taken as the unit and the required data are plotted directly on enlarged aerial photographs with the aid of the plane table. From aerial photographs and superposed data tracings are made which constitute rough diagrammatic maps. These show sufficiently well whatever is necessary

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[21]See the U.S. National Emergency Council's United States Government Manual, 1935 (Washington, 1935), p. 481. This manual was first issued by the Council in 1935 as a textbook "designed to inform every citizen as to government procedure and to make effectively available all Federal services." The manual is published in loose-leaf form and is currently kept up to date by the addition of new or substitute pages. The information presented has been authenticated and approved by the heads of the respective departments and agencies and their chief counsel.

[22]"Report of the Committee on Mapping Services," op. cit., p. 248.

as a basis for cooperative agreements with landowners regarding work to be done on private lands. But the photographs themselves, either individually or in mosaics, must be employed in most of the work, since they alone show the vegetation, erosion gullies, field boundaries and other essential factors in soil erosion studies. Thus the only ordinary mapping performed under the direction of the Soil Conservation Service involves the surveying of a specific project area of one hundred square miles in the Navaja Indian Reservation. This work is being done under contract by a commercial firm, the method employed being aerial photography with mechanical contouring based on stereoscopic projection. The resulting product will be topographic maps published on two scales, namely, 1:24,000 and 1:12,000 with a contour interval of twenty feet.[23]

In cooperation with the National Resources Board, the Service has completed a reconnaissance survey of erosion in the United States and has translated the results in a series of 28 maps -- one of the United States on the scale of 1:5,000,000 which represents a fourth refined edition of the Service's original map, and 27 separate maps covering 31 states, usually on the scale of 1:500,000.[24] Detailed erosion surveys are now under way in connection with demonstration projects in various sections of the country. However, the Service does not ordinarily publish its maps. A monthly publication entitled Soil Conservation has been issued by the Service since August, 1935. It includes a list of available soil conservation publications and is obtainable from the Superintendent of Documents, Washington, D.C., at the subscription price of one dollar a year.

FEDERAL POWER COMMISSION

The Federal Power Commission is an independent government agency. It was created under the Federal Water Power Act of June 10, 1920, was reorganized under the Act of June 23, 1930, and had its powers increased under the Public Utility Act of August 26, 1935. Its chief functions are the investigation of the power resources of the country; the control through licenses of the development and distribution of water power projects on navigable streams or affecting the interests of interstate commerce or of

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[23] Ibid., p. 249.

[24] American Yearbook, 1935, p. 266.

public lands; and jurisdiction over the interstate movement of electric energy. The Commission, in fine, is authorized to conduct general investigations of power resources and of their relation to interstate and foreign commerce, and of the power industry and its relation to other industries; to cooperate with state and national agencies in its investigations; and to publish the results of its work in special and annual reports.[25] In connection with the discharge of these functions the Commission compiles maps and requires its licensees to prepare maps fulfilling specifications prescribed by the Commission.

Nature and Scope of Mapping Services

The Federal Power Commission does not engage in surveying, and does no original cartographic work. Other organizations, including the Geological Survey, the Corps of Engineers, the Forest Service and the Bureau of Reclamation, are called upon to do any surveying or field mapping required. The Commission's mapping activities are exclusively limited to the compilation of such maps as are necessary to facilitate its studies and to illustrate its reports. Ordinarily blueprints or photostats suffice, the work usually being done for the Commission by the Corps of Engineers of the War Department. It was thus, for example, that the Corps of Engineers recently (1935) issued through its Engineer Reproduction Plant, at Washington, a map of the United States, in twenty-three sheets and one index-chart, entitled Potential Water Power Map. The base of the map is an enlargement to the scale of 1:1,250,000, from a U.S. Geological Survey map on the scale of 1:2,500,000. The index-chart that accompanies the map is on the scale of 1:7,000,000.

The Commission also requires its licensees to submit general and detailed maps of projects, the detailed maps being commonly on scales of 400 feet, 1000 feet, or 2000 feet to the inch; certain ones of these maps are provided with contour lines of not more than 10-foot intervals. The Commission thus indirectly secures data that may have potential value for a national mapping program.

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[25] United States Government Manual, 1935, op. cit., p. 155.

Two Recent Maps

Two important maps based on such data have recently been published by the Commission. The first is entitled: Service Areas of the Principal Electric Utility Systems in the United States. The service areas represent territories (on a township basis) served by the companies owned and controlled by the principal holding companies and other important electric utility systems of the country. Fifty-seven major utility systems and eight large municipal systems are separately identified. Fifty minor holding companies and independent operating companies are represented on the map by a group color. The map measures 51 1/2 x 81 inches, and is constructed on the scale of 1:2,500,000 (approximately 40 miles to the inch). The second map is entitled: Principal Generating Plants and Electric Transmission Lines of the United States. It covers approximately 90 per cent of the combined generating capacity of the industry's plants. City, county, and state names are shown in black; rivers in blue; oceans and lakes are tinted; transmission lines and fuel generating plants are indicated in red; hydroelectric plants in dark blue, and congested areas are shown on enlarged inserts. This map measures 57 1/2 x 84 inches, and is likewise plotted on the scale of 1:2,500,000. The two maps are stated to be the most accurate and comprehensive presentations of their kind in the United States. They were issued in 1935, and are obtainable from the Federal Power Commission, Washington, D.C. A descriptive folder is available free.

The mapping activities of the Commission are thus fundamentally limited to compilation work; they constitute a subsidiary service specialized in character and chiefly incidental to and necessary for the effective discharge of other major functions. The Commission's general maps are usually available to the public at the cost of reproduction. Its detailed maps are considered confidential, though they are available to other government services.[26]

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[26]"Report of the Committee on Mapping Services," op. cit., p. 304.

GENERAL LAND OFFICE

The General Land Office,[27] in the Department of the Interior, is one of the oldest surveying and mapping agencies of the Federal government, for it dates back to 1785. It was established to supervise, manage, and dispose of the public lands of the United States. Its major functions include the adjudication of all claims to the public lands initiated under the numerous public-land laws, including applications for coal, oil, gas prospecting permits and leases, and right-of-way grants over the public lands to railroads.

A cadastral engineering service is maintained by the General Land Office for the execution of surveys and resurveys of the public lands, the preparation and maintenance of plat and field-note records thereof, and the approval and platting of mineral surveys executed by United States mineral surveyors.[28] It is important to note, however, that the General Land Office does not proceed with subdivisional surveys except upon the application of settlers, or in pursuance of requests submitted by the several Federal bureaus and state agencies where public lands are involved. Some twenty-five district land offices are maintained by the General Land Office in the western part of the United States and in Alaska for the purpose of receiving applications to enter public lands, take initial action thereon, render decisions, keep tract-book and plat records showing the status of the public lands, and to dispense information.

It thus appears that the General Land Office combines a major surveying function with functions that are strictly legal and administrative in character. The major surveying activities result in a specialized type of map known as the "township plat," although other surveying and mapping activities are executed as authorized.

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[27]See also Milton Conover, The General Land Office, Its History, Activities and Organization, "Service Monograph of the United States Government," No. 13 (Baltimore: Institute for Government Reserach, 1923).

[28]United States Government Manual, 1935, op. cit., p. 79-80.

## Nature and Extent of Surveying and Mapping Activities

Subdivisional or land-parcelling surveys of the public domain constitute one of the major surveying activities of the country. The total area of these lands in the United States and Alaska is approximately 1,820,000,000 acres, and of this total about 28 per cent remains yet to be surveyed. While original surveys are decreasing substantially toward their end, the proportion of complicated resurveys is relatively growing. There is apparently no predictable limit to the extent of resurveys which may be required.

The cadastral surveys which subdivide the public lands into townships, sections and smaller divisions are executed in accordance with a definite procedure. The township plats which incorporate the results of these surveys are usually drawn to the scale of 1:31,680, or two inches to the mile. Except in rare instances, these maps do not display adequate topography of the terrain covered, or topography based on adequate vertical control. These elements of a good map, while recognized by the General Land Office as of real value in their work are not considered essential to the primary object of the cadastral survey and are generally omitted for reasons of economy. The absence of these various elements of a good map distinguishes the township plat as something apart from the ordinary cartographic product, something more in the nature of a plan or working diagram designed for one special purpose and having but limited use in other fields.[29]

On the basis of township plats and other available data, the General Land Office also compiles a series of state maps covering the twenty-nine public land states in the United States, and also in Alaska and Hawaii. It issues annually a large wall-map of the United States on the scale of thirty-seven miles to the inch, measuring 5 x 7 feet. On this map are shown the extent of the public domain; the national parks, monuments, and forests; the Indian Reservations; military, bird, and game reserves; the boundaries of national reclamation and reservation projects; and also inserts of the territories and insular possessions.

All the maps of the General Land Office, with the exception of the township plats which are obtainable from the land

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[29]"Report of the Committee on Mapping Services," op. cit., p. 220.

offices only, are purchasable from the Superintendent of Documents, Washington, D.C. The maps obtainable from this latter source are listed in the current editions of Price List 53, also issued by the Superintendent of Documents.

OFFICE OF INDIAN AFFAIRS

The Office of Indian Affairs, in the Department of the Interior, has charge of all Indian affairs and of all matters arising out of Indian relations. These functions include the education and training of the Indian, individually, tribally and economically; supervision of the management of Indian forests and range lands; and the development and maintenance of irrigation projects on Indian reservations. In connection with certain of these activities, such as irrigation, drainage, power development and other construction work, a considerable amount of surveying and mapping has been found necessary.[30]

Mapping in the usual sense of that term is rather limited in amount, however, and no special surveying or mapping service is maintained within the organization. Topographic surveys are usually made simultaneously with timber cruises and range appraisals, the field work being executed on a scale of four inches to the mile, or on still larger scales, such as one inch to one thousand feet, one inch to four hundred feet, and one inch to one hundred feet. In a few instances, where small-scale maps have been needed for fire protection and timber cruising on forested Indian lands, and such maps had not been prepared by the Geological Survey, the General Land Office, or other agency, the Office has extended the geodetic control of the Coast and Geodetic Survey and the Geological Survey, and has prepared either planimetric or hypsometric maps, as required by its needs, on the scale of one inch to the mile. Most of this work is thus performed incidentally to other activities. The maps resulting therefrom show data that are not incorporated in ordinary maps, such as the location of fire-control stations, administrative sites, agency headquarters and irrigation projects and springs. Such maps have been compiled for most of the Indian reservations. The Navajo country has been covered with aerial photography by a commercial firm under contract, though the maps have not yet been completed. Irrigation project maps and miscellaneous small maps are

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[30] Ibid., p. 243.

blueprinted. All these maps are primarily for administrative use and most of them are not available to the public.

BUREAU OF RECLAMATION

The Bureau of Reclamation, in the Department of the Interior, has as its major functions the investigation, design and construction of works for the conservation and utilization of water for irrigation and power purposes. It has, in particular, supervision over the construction of Boulder Dam and the Grand Coulee power dam, and the development of the Colorado and Columbia river basins.[31] A large amount of surveying and mapping is performed by the Bureau in connection with these functions.

Practically all the surveying and mapping work of the Bureau is conducted as an integral part of, and simultaneously with, other activities involved in the investigation of projects and construction of works for the use of water. The contour maps produced are normally of reservoir sites, canal routes and the sites of irrigation and power structures. The scales employed are usually much larger than any appropriate to a general mapping program of the country, for they vary mostly from 1:1,200 to 1:480. Where reconnaissance topographic maps of large areas are necessary for preliminary studies, and standard topographic maps do not exist and cannot be produced by another government agency, the Bureau uses the General Land Office maps as a base on which to sketch rough contours.[32] Reproductions of the Bureau's maps are either by photostat or by direct process.

The Bureau of Reclamation is the sole distributing agency for all of its publications, including its maps, charts, and plats. Descriptive price-lists for these have been issued by the Bureau; they may be found noted in the appended reference list of the maps and map sources of the Federal government.

HYDROGRAPHIC OFFICE

The Hydrographic Office in the Bureau of Navigation of the Navy Department grew out of the Depot of Charts and Instruments established in 1830. Its successor, the Hydrographic Office, was created by an organic act of Congress, in 1866. This act authorized it to improve the means of safely navigating vessels

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[31] United States Government Manual, 1935, p. 80.

[32] "Report of the Committee on Mapping Services," op. cit., p. 246.

of the Navy and of the mercantile marine "by providing . . . . accurate and cheap nautical charts." Though the reproduction of data compiled from outside sources, including charts issued by foreign governments, accounts for the large majority of the charts issued by the Hydrographic Office, original surveys have constituted part of its program from a very early date of its existence.

It may perhaps be noted that the activities of the Hydrographic Office are in some respects similar to those of the Coast and Geodetic Survey, in the Department of Commerce. Their activities do not overlap, however, but are mutually supplementary. The primary function of the first is specific and military, that of the second is general and civil. The Coast and Geodetic Survey operates in the coastal waters of the United States and its possessions; the original surveys of the Hydrographic Office are now limited in general to foreign waters and the high seas, although numerous surveys of coastal waters of the United States territorial possessions have been executed by this office in the past. More specifically, the foreign surveys of the Hydrographic Office include large areas in the Caribbean Sea bording the coasts of Cuba, Haiti, Guatemala, Honduras, Nicaragua, Panama and certain sections of the coasts of Columbia and Venezuela; also the coast of Central America. Smaller areas in all parts of the world have been surveyed as opportunity afforded.

These foreign surveys are conducted for strategic reasons, and in aid of American shipping where the countries having jurisdiction have not executed satisfactory surveys of their coastal waters. Of the 420 new charts issued by the Hydrographic Office on the basis of original surveys, 380 are in active circulation at present.[33]

### The Compiled Charts of the Hydrographic Office

The production of charts based on data secured from sources other than original surveys of the Hydrographic Office, constitute the major cartographic activity of this office. Of the 2800 charts published by the Hydrographic Office on this basis, 1500 are said to be "compiled from other sources" and 1300 "from direct reproduction of other charts." Of the total of 2800 charts 2520 are in active circulation and are revised or replaced whenever corrections

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[33] Ibid., p. 254.

have become extensive or important enough to warrant this step. All such revisions or new chart editions are immediately made known in the weekly leaflet Notice to Mariners, and in the weekly Hydrographic Bulletin, both issued by the Hydrographic Office.

The Hydrographic Office has also prepared several hundred confidential charts; and has published for both naval and general use a series of 62 "strip aviation charts," or strip maps, compiled from existing cartographic data and covering coastal belts of the United States, Mexico, Central America, the West Indies and certain adjacent territories. The work on these latter charts has now practically ceased, however. In addition to these strip maps the Hydrographic Office has produced a few "Sectional area charts," on the scale of 1:1,000,000, covering large areas in the southwestern and northeastern United States. These charts are for official use only.

## Publications Supplementing Information Shown on Hydrographic Charts

A list of the publications of this nature compiled and published by the Hydrographic Office is as follows:

(1) Monthly and quarterly Pilot Charts of the several oceans and the Caribbean Sea; these have been issued continuously over the past fifty years;

(2) 56 volumes of nautical Sailing Directions or Pilots for the entire world exclusive of the United States and its possessions; individual annual supplements to these volumes are also issued;

(3) Light Lists of the entire foreign world, constituting a series of six volumes, one volume of which is republished each year;

(4) Notice to Aviators, published monthly and giving information concerning air harbors and air routes, aids to navigation of the air, scientific articles on development of aerial navigation, etc.

(5) Naval Air Pilots, a series of volumes (at present confidential) designed to serve the needs of naval aircraft in the same way that the Sailing Directions or Pilots serve the needs of ordinary ships;

(6) Notices to Mariners, published weekly and containing data for correction of charts, sailing directions, light lists, etc.

(7) Hydrographic Bulletin, issued weekly as a single large sheet containing latest information concerning dangers to navigation and other valuable data;

(8) Ice Supplement to the Hydrographic Bulletin, issued weekly during the season of dangerous ice, and showing latest reports on floating ice near steamer lanes;

(9) Daily Memorandum, another supplement to the Hydrographic Bulletin, issued daily except Sundays and holidays and giving prompt notice of important navigation changes affecting the safety of ships at sea, the most urgent items being broadcast by radio;

(10) Radio Aids to Navigation, a volume issued at intervals of a year or eighteen months, with supplements bringing it up to date when issued, giving lists of radio compass stations, and of radio stations transmitting fog signals, weather bulletins, storm and navigational warnings and time signals; and, finally,

(11) Mine warnings, and various manuals and tables indispensable to navigators both in the Navy and in the merchant marine.[34]

The total number of copies of the more important periodical publications issued by the Hydrographic Office in the course of a year ranges between 150,000 and 300,000 copies. For the engraving and printing of these publications the office maintains a large reproduction plant in which it utilizes pantogravers of its own development for the mechanical engraving on copper, and other improved processes of chart reproduction.

### Catalog of Hydrographic Office Publications

A comprehensive catalog very adequately supplied with index charts and diagrams covering all of the Hydrographic Office's chart and other publications is issued by it at intervals of approximately four years. The title of the current edition (1935) of the catalog is General Catalog of Mariners' and Aviators' Charts and Books. It is available free only to those having need for a complete catalog.

## POST OFFICE DEPARTMENT: DIVISION OF TOPOGRAPHY

As an aid to the collection and distribution of mail, the Post Office Department maintains a Division of Topography which compiles various post route and rural delivery maps. These maps serve primarily as guides for determining the necessity of establishing new post offices, of extending or curtailing existing route services, the mail service to let under contract, the parcel post number for post offices and the most efficient scheme of mail delivery.

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[34] Ibid., pp. 251-52.

## Early Post Route Maps Issued by the Division of Topography[35]

The first attempts at topographic mapping in the Post Office Department may be dated back to the year 1836, at which time a clerk in the department was first assigned to the duties of topographer. The position was not filled officially, however, until 1847. It has been in continuous existence since that time.

Available records would indicate that between 1837 and 1862 maps were prepared by the topographer for official use only. But in the latter year the topographer was directed by the Postmaster General to prepare a set of postal maps, by states or groups of states, which maps were to show all the permanent postal routes, postal distances, and post offices in the United States. These maps were copyrighted in the name of the Postmaster General, and placed on public sale. Existing records show that the following maps were thus published:

(1) Post route maps of the New England States (1866)

(2) Post route maps of New York (1868)

(3) Post route maps of the State of Maine, with parts of adjacent states and provinces (1869)

(4) Post route map of Pennsylvania, New Jersey, Delaware, Maryland, and District of Columbia (1869)

(5) Post route map of Ohio and Indiana (1870)

(6) Post route maps of Michigan and Wisconsin (1871)

(7) Post route map of Illinois, Missouri, and Iowa, with adjacent parts of Wisconsin, Minnesota, Nebraska, and Kansas (1873). (A description of the map appears in the report of the Postmaster General. The library in the Post Office Department knows of no copies at the present time.)

(8) Two new editions of all maps issued since 1866, were issued in 1874. (See the Annual Report of the Postmaster General. The library in the Post Office Department knows of no copies at the present time.)

(9) Post route map of Arkansas and part of Indian Territory (1874). (See the Annual Report of the Postmaster General. The library in the Post Office Department knows of no copies at the present time.)

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[35]For the facts and map descriptions contained in this chapter and in the corresponding section of the appended reference list of government maps and map sources, grateful acknowledgment is made to the Chief Inspector of the Post Office Department, Mr. K. P. Aldrich.

(10) Post route maps of Virginia and West Virginia; North Carolina and South Carolina; Alabama and Mississippi; Louisiana and Texas; Nebraska and Colorado (1875). (See the Annual Report of the Postmaster General. The library in the Post Office Department knows of no copies at the present time.)

(11) New editions of all maps issued since 1866, except Minnesota, were issued in 1875. (See the Annual Report of the Postmaster General. The library in the Post Office Department knows of no copies at the present time.)

(12) Post route map of Pennsylvania, New Jersey, Delaware, Maryland, District of Columbia, with adjacent parts of New York, Ohio, Virginia and West Virginia (October 1, 1885).[36]

Some Post Route Maps of Historical Significance

The following list of historical post route maps has also been kindly supplied by the Chief Inspector of the Post Office Department:

(1) Map of New England, New York, New Jersey, and Pennsylvania, earliest known map of the post roads of the United States (1729), by H. Moll, Geographer. (A copy of this map is available from the Post Office Department.)

(2) Map of the roads of the United States of America (1789), by Christopher Colles. (On file in the Library of Congress.)

(3) Map of the United States showing post roads (1796), by Abraham Bradley, Jr. (On file in the Library of Congress.)

(4) Recent map of Tennessee, marked in red tracing to show the original post route to Knoxville in 1795, and on to Nashville in 1796, and continuing out of Nashville to the south. Prepared and certified by the State Historical Society. (On file in the Post Office Department library.)

(5) Map of the Natchez Trace, from Nashville in Tennessee, to Natchez in the Mississippi Territory, about 1800. (The original is on file in the office of the Chief of Engineers, War Department; a copy is in the library of the Post Office Department.)

(6) Map of the United States; map of the southeast quarter of the United States, exhibiting the post roads, the situations, connections and distances of the post offices, stage roads, counties and principal rivers (1804), by Abraham Bradley, Jr. (On file in the library of the Post Office Department.)

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[36]Note: Unless otherwise indicated, copies of the maps are on file in the Library of Congress.

Current Mapping Activities

The current mapping activities of the Division of Topography are almost exclusively restricted to map compilation work.[37] No field employees are assigned to the division and no real surveying is performed; but rough sketches of rural delivery routes and of changes therein are supplied by post office inspectors. The maps are unlike those produced by any other government bureaus or commercial firms. They do not represent relief of the country and omit much other detail common to standard maps. Although called maps, they are more in the nature of diagrams or plans. Reproduction is to a considerable extent by blueprint or photostat, but state maps and some others are printed by photolitography in the reproduction plant of the United States Geological Survey. All material is prepared primarily for use of the postal service and public distribution is not encouraged. Correction of existing maps constitutes no doubt the most formidable as well as most persistent task of the division.

For a more detailed enumeration and description of the various types of maps issued by the Division of Topography, see the corresponding section in the appended reference list of United States government maps and map sources.

INTERNATIONAL BOUNDARY COMMISSION:
UNITED STATES AND MEXICO

The American Section, in the Department of State, of the International Boundary Commission, United States and Mexico, is charged to cooperate with the Mexican Section in examining and deciding all differences of questions affecting the location of the 1,321 miles of boundary line formed by the Rio Grande, the 19 miles of boundary represented by the Colorado River, and the 673 miles of land boundary extending from El Paso to the Pacific Ocean.[38] The performance of these functions makes it necessary that the Commission execute a large amount of miscellaneous surveying; that it make detailed surveys and large-scale maps of present and abandoned river channels and continuous territory; and that it prepare a limited number of small-scale maps showing general features of the boundary zone. The headquarters of the

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[37]"Report of the Committee on Mapping Services," op. cit., p. 291.

[38]United States Government Manual, 1935, pp. 309-11.

American Section of the Commission are in El Paso.

It may perhaps be noted that this Commission differs in essential respects from the International Boundary Commission elsewhere described. Thus while the boundary treaties with Canada do not provide for a commission as such, and merely delegate to an individual in each country the duties of performing certain tasks, the treaty with Mexico specifically sets up a commission which is an international agency and acts as a unit.

### Major Surveying and Mapping Activities

One of the principal surveying and mapping activities of the Commission is occasioned by abandoned river channels surrounding "bancos" or cut-off portions of the flood plain, in order that the precise location and area of these may be ascertained and jurisdiction over them be assigned to one country or the other. These surveys result in numerous local blueprint maps of bancos on the scale of 1:5,000 (a few on the scale of 1:10,000) without contours and not published, although reductions of them appear in published boundary reports. A certain number of such reports illustrated with maps has been issued by the Commission since 1856. However, the number of copies printed of each report was always very limited, and the publications ceased to be available after the first editions. Those desiring to make a study of boundary matters must of necessity go to the Library of Congress to refer to complete collections of these reports, though a few copies of them may be found in western libraries, and in state and county offices in Texas. A summary outline of the most significant reports illustrated by boundary maps has been kindly made available by United States Commissioner, Mr. L. M. Lawrence. It has been reproduced, under the main heading of "State Department," in the appended reference list of United States government maps and map sources.

## WAR DEPARTMENT: CORPS OF ENGINEERS, U.S. ARMY

The surveying and charting activities of the Coast and Geodetic Survey, in the Department of Commerce, which practically cover all the important coasts, intracoastal waterways, and harbors of the United States and possessions, are supplemented, with respect to the principal river and inland harbor systems of the country, by similar work performed by the Corps of Engineers of the U.S. Army. These principal water systems are as follows:

the Great Lakes, together with the New York State Barge Canal and the Hudson River; the Mississippi, Missouri, Ohio, the Illinois River to Chicago, and their important tributaries; the rivers of the Atlantic coast including the intracoastal waterway system connecting these rivers; the rivers of the Gulf coast, an inland waterway extending from Apalachicola River in Florida via New Orleans down the Texas coast to Corpus Christi, connecting with southern Alabama, Mississippi, Texas and Louisiana waterways, and with the Mississippi River System; the San Joaquin-Sacramento system in California; the Columbia system in the northwest and the smaller Pacific coast rivers. These are improved, or in course of improvement, in order to provide navigation facilities commensurate with their commercial importance.[39] Some 200 principal streams of the United States are thus administered by the Corps of Engineers.

## Major Functions

The major functions of the Corps of Engineers fall into two distinct groups: civil and military. The civil functions include the planning, construction and maintenance of various public work projects undertaken for the improvement of rivers and harbors and for the control of flood waters; the regulation or operation of certain public works, and the investigation or supervision of structures erected in or over navigable waters. The military functions include the planning and execution of a great variety of engineering works required by the Army for military purposes. An enormous amount of surveying is prerequisite to the planning and construction of both civil and military works; mapping activities in the strict sense of the term are less extensive, though they are of considerable magnitude.

## Surveying and Mapping Activities

The miscellaneous surveying necessary in preparing and executing plans for a great variety of civil and military construction works constitutes by far the most important surveying activity of the Corps of Engineers. Many large-scale topographic maps and hydrographic charts are thus produced, although they are not generally made available to the public. They include a large group

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[39] American Yearbook, 1935, p. 319.

of strip maps of rivers showing soundings in the streams and contours and culture along the banks, issued on such scales as one inch to eight hundred feet, or 1:15,000, etc. These river strip maps are more of the nature of charts and are not usually published. They are essential to the execution of studies imposed upon the Corps of Engineers by law and do not duplicate work done by other mapping agencies.[40] Topographic quadrangle mapping on standard scales is engaged in by the Corps of Engineers only to the extent necessary to meet emergencies caused by lack of essential cartographic data. A considerable amount of such mapping is done, however, for the Mississippi River Commission, as will be shown later.

Geodetic small-scale topographic mapping, more or less comparable with work performed by the Geological Survey, is prosecuted by the Corps of Engineers on an extensive scale for military purposes. The maps thus produced by Army engineers are designated as "tactical maps." They are now published on the standard scale of 1:62,500, commonly employed by the Geological Survey, and are designed to cover a broad border zone of the country. Approximately 1200 such quadrangle maps have been issued to date (1935), of which 350 are said to be revisions of old maps, 400 are without contours and are results of reconnaissance surveys in previously unmapped areas; the remaining 450 maps are contoured. Of these latter, 250 are described by the Office of the Chief of Engineers as "of the present day standard of accuracy and completeness," the remainder being regarded as obsolete because of changes in culture since the original surveys.[41] Approximately 15 quadrangles on the scale of 1:62,500 have been published annually in recent years. Many quadrangles are reproduced in black only but many others are in three and some are in four colors, after the general pattern of standard Geological Survey topographic maps. With respect to the quality of these maps, the Committee on Mapping Services found that "only a limited number are of such quality that they can replace Geological Survey sheets," and that "comparatively few of the maps are of sufficiently high quality to be incorporated into the standard map of

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[40] "Report of the Committee on Mapping Services," op. cit., p. 265.

[41] Ibid., p. 266.

the country, or to obviate the necessity of resurvey before satisfactory maps of the areas involved are available."[42]

No index charts or map lists are in general compiled for these maps of which a wide distribution is, moreover, not desired by the Corps of Engineers. A certain number of the maps and charts not containing confidential information is, however, obtainable on request by persons in need of them. A detailed list of these publications and their sources has been included under the main heading of "War Department," in the appended reference list of United States government maps and map sources.

For the reproduction of its plans, maps and charts, the Corps of Engineers maintains in Washington a large Engineer Reproduction Plant. No engraving is done, however, and reproduction is by photolithography from finished drawings.

### Geographical Distribution of Corps of Engineers Offices

For reasons of administrative convenience and efficiency the operations of the Corps of Engineers are distributed among the following ten major engineer divisions: North Atlantic Division; South Atlantic Division; Lower Mississippi Valley Division; Upper Mississippi Valley Division; Great Lakes Division; Ohio River Division; Gulf of Mexico Division; Missouri River Division; North Pacific Division; and South Pacific Division. Each of these divisions is headed by a division engineer who has charge over the local district engineer offices into which each division is subdivided. The work of the divisions as a whole is under the direction of the Board of Engineers for Rivers and Harbors, Washington, D.C., of which the Chief of Engineers is the executive officer.

One of the most prolific as well as important surveying and mapping agencies among the Corps of Engineers divisions is the Mississippi River Commission in the Lower Mississippi Valley Division. The role played by the Mississippi River and its watershed is, moreover, of such great significance that a brief account of the cartographic history of the river may not be out of place.

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[42] Ibid., p. 267.

## The Mississippi River, and the Work of the Mississippi River Commission

### The Mississippi Watershed

The vast and far-flung Mississippi River system with its constant flux in navigability and its frequent and disastrous floods, has long presented one of the most formidable and persistent surveying and mapping problems of the Federal government. The tremendous spread of this watershed is revealed by the fact that it drains no less than 1,245,000 out of the total of 3,050,000 square miles of land area comprising the continental United States, and that it thus covers part or all of thirty-one states and two Canadian provinces. In fact, the vastness of this watershed is exceeded in size by only those of the Amazon and the Congo Rivers, which drain, respectively, 1,722,000, and 1,425,000 square miles of area. It exceeds, however, by approximately 140,000 square miles, the drainage area of the Nile, is almost twice as large as that of the Volga, and nearly three times as large as that of the Ganges.[43]

The most interesting feature of the entire Mississippi watershed is the alluvial valley. It lies within the natural flood area of the river basin and extends, geographically, from Cape Girardeau, Missouri, to the approximate latitude of Baton Rouge, Louisiana. This flood plain includes also the lower reaches of the tributary stream basins inasmuch as the latter are inundated by backwater from the main river.

### Historical Apercu

Credit for having been the first white man to discover the Mississippi River is popularly accorded to the Spaniard, Hernando de Soto, who sighted the river on May 8, 1541, near or below the present location of the city of Memphis. Evidence is available, however, to support the contention that the river's existence was known to western explorers before that date, for the "Admiral's Map" which appears to have been engraved in 1507, shows unmistakably the mouths of the Mississippi which is there called "River of Palms."[44] Historical evidence links this map

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[43]Dabney Otey Elliott, The Improvement of the Lower Mississippi River for Flood Control and Navigation (3 vols.; War Department: U.S. Waterways Experiment Station, Vicksburg, Mississippi, 1932), I, 24.

[44]Ibid., I, 4.

with the fourth voyage of Columbus (1502), and indicates that he may, in fact, have been the first European to note the existence of the river.

De Soto's discovery was not followed up, however, by the Spanish government, and it is to the French that credit is due for the first systematic explorations of the river and of many of its tributaries. Among the most important names in the early history of the river may be mentioned those of Joliet (1663) and of his assistant, Father Marquette, and those of La Salle (1682), and d'Iberville (1699). Of these, La Salle was the first person to descend the river throughout the greater part of its length to its outlet into the Gulf, while d'Iberville was first in definitely establishing the single identity of the vast river traversed by La Salle.

## Early Mississippi River Maps

Maps are among the most valuable and interesting historical records of the river. Of these, the most detailed and accurate are perhaps the early Mississippi River maps that resulted from the reconnaissance surveys of the lower river, and were made, respectively, by Lieutenant Ross (1765), Captain Philip Pitman (1768), William Wilton (1774), and General Victor Collot (1796).[45] The first three of these maps were probably made from compass bearings and estimated distances. The Wilton map is drawn on a scale of one inch to two miles, and is apparently the result of an accurate cadastral survey. This latter map is now in the possession of the Mississippi River Commission, at Vicksburg, Mississippi.

The period of the Federal government's surveying and mapping activities along the Mississippi River dates from about 1820, by which time the era of discovery and settlement had come to a close, and the river was then entirely within the territorial limits of the United States. The first appropriation for the preparation of surveys, maps, and charts for a portion of the Mississippi and Ohio Rivers was made by Congress in that year, and in 1821 the first survey of the Lower Mississippi was actually

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[45]See the historical analysis of the Ross, Pitman, and Collot maps, supplemented by full-size reproductions, contributed by Captain Carl F. Palfrey to the U.S. Army's Annual Report of the Chief of Engineers for 1893 (Washington: Government Printing Office, 1893), Part V, pp. 3703-8.

commenced. It was not, however, until 1850 that Congress authorized the first systematic and scientific investigation of the Lower Mississippi River. In the meantime the Upper Mississippi was also receiving attention. Surveys of this part of the river had been undertaken as early as 1829, and by 1879 the first complete map of the river from St. Paul to the Gulf of Mexico was published.[46]

## The Mississippi River Commission

The Mississippi River Commission, created by Congress in 1879, is an offshoot of the Corps of Engineers of the U.S. Army. Its major functions have to do with the improvement of navigation on the Mississippi River by planning and executing works to correct, permanently locate and deepen the channel and protect the banks; and to control floods on the river and its tributaries. In order to perform these functions effectively the Commission executes a vast amount of miscellaneous surveying incidental to planning and construction work. The results have been made available in a vast number of maps which not only furnish detailed topographic information, but also serve as bases for the measurement of progressive channel changes of the river.[47]

The Flood Control Act of 1928 introduced considerable changes in the set-up and functions of the Commission. It transformed the Commission from an executive into a consultative and advisory body, and distributed active administration of the Mississippi River system among the following three Corps of Engineers divisions: the Upper Mississippi Valley Division, including the upper reaches of the river above Cairo; the Lower Mississippi Valley Division, covering the river's reach between Cairo and Baton Rouge; and the Gulf of Mexico Division, covering the river below Baton Rouge. Each of these three engineer divisions is directly answerable to the Chief of Engineers in Washington. Other results of the reorganization were the removal of the headquarters of the Commission from St. Louis, Missouri, to Vicksburg, Mississippi; and the designation of the president of the Commission as the division engineer of the Lower Mississippi Valley Division. The

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[46]Elliott, op. cit., I, 142.

[47]A series of modern plans showing the progressive channel changes of the river from 1765 to 1930 is appended to Vol. III of Mr. Elliott's work.

office of the president of the Commission and that of the division engineer now operate as a single organization. It should be noted, however, that this reorganization did not affect the jurisdiction of the Commission with respect to navigation improvement between Cairo and Baton Rouge, or flood control work on the main river, its tributaries, or outlets. This remains essentially what it was before the passage of the Flood Control Act.[48]

## Mapping Activities of the Mississippi River Commission

A large amount of topographic mapping has been executed by the Commission in order to provide essential cartographic data in a region where few topographic maps had been issued by the Geological Survey. It was thus, for example, that the Commission made preparation, during 1929-33, for the standard survey and topographic mapping of the entire alluvial valley of the Lower Mississippi River. Of the total of 204 quadrangles comprised within the area to be covered by the resulting map, 177 were assigned for mapping to the Mississippi River Commission, and the remaining 27 quadrangles to the Topographic Branch of the Geological Survey. The latter quadrangles are chiefly located in the vicinities of Cairo, Illinois, of Lake Pontchartrain, and of the Yazoo River Basin. Preliminary editions, and a few final ones, of the Commission's 177 quadrangle maps have all been issued; and of the Geological Survey's share of 27 maps approximately one-half have been published to date.

All the quadrangles are to be mapped on the standard scale of 1:62,500, with relief indicated by contour lines. The format of the Army maps is similar to that of the Geological Survey's standard topographic quadrangles, except for certain differences in symbols and certain other features. For example, the vertical control of the Commission's maps is based on local mean Gulf level at Biloxi, Mississippi, whereas the standard maps are based on mean sea level.[49] Again, the Mississippi River Commission employs on certain of its maps a 25-foot contour interval, instead of the 20-foot interval normally employed on standard topographic maps

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[48] Ibid., I, 27.

[49] "Report of the Committee on Mapping Services," op. cit., p. 286.

of the eastern half of the country. A rather more serious defect, according to the findings of the Committee on Mapping Services is the fact that the Commission's maps are "distinctly less accurate and therefore less reliable than corresponding maps prepared by the topographic engineers of the Geological Survey." The Committee finds, in particular, that contour lines on the Commission's maps are "more generalized, more rigid in appearance and less expressive of variation in terrain than are those on standard maps."[50]

Numerous other comprehensive series of maps not duplicated by Federal agencies elsewhere have also been prepared by the Commission. A detailed list of these maps and available map lists and index charts is included in the appended reference list of United States government maps and map sources. The maps of the Mississippi River Commission are not widely known, for they are not regularly deposited with educational institutions receiving the Geological Survey maps. The new maps of the Commission are obtainable only upon special order directed to its headquarters at Vicksburg, Mississippi.

## III. Incidental Mapping Agencies of the Federal Government

The Federal government agencies only indirectly concerned with mapping are nine in number. A brief description of these will conclude this attempt at a summary exposition of the mapping activities of the various departments, bureaus or services of the Federal government.

### BUREAU OF AGRICULTURAL ECONOMICS

The Bureau of Agricultural Economics, in the Department of Agriculture, studies the economics of production and marketing, farm organization and management, land economics and other problems relating to rural life. It cooperates with the Agricultural Adjustment Administration, especially in providing authentic data on which adjustment programs are based.[51]

In connection with land utilization and the production and distribution of farm products the Bureau compiles statistical data in the form of diagrammatic charts, "dot maps," pictograms,

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[50] Ibid., p. 288.

[51] United States Government Manual, 1935, p. 93.

etc., some of which have been included in the Atlas of American Agriculture and in other publications. The Bureau does not, however, engage in field surveying or ordinary mapping, and maintains no map reproduction plant.[52]

The Division of Program Planning of the Agricultural Adjustment Administration, which is in part engaged in similar work in close cooperation with the Division of Land Economics of the Bureau of Agricultural Economics, has compiled a very small-scale contour map of the Southern Appalachians on the basis of existing standard topographic maps, and has prepared land utilization maps by color-overprint on Geological Survey base maps. These mapping activities of the Bureau must be considered as essentially incidental to other major functions.

BUREAU OF AGRICULTURAL ENGINEERING

The Bureau of Agricultural Engineering, in the Department of Agriculture, deals with the engineering problems of agriculture, especially as they affect family-size farms. Prior to 1920 the Bureau made a large number of surveys for the purpose of designing systems of drainage and flood control. But such work has not been engaged in by the Bureau since that time.[53]

In connection with researches in agricultural engineering, particularly in irrigation, drainage and soil erosion control, the Bureau produces large-scale maps of restricted areas, generally of one farm or less, for specific investigations. Such maps are made purely incidental to researches on the general effects of different kinds of improvements upon agricultural uses of land. The surveying and mapping activities of this bureau are therefore limited to large-scale maps of very restricted areas for research purposes. They are incidental to other work.

BUREAU OF AIR COMMERCE

The Bureau of Air Commerce, in the Department of Commerce, establishes, operates and maintains airways and aids to air navigation, such as intermediate landing fields, beacon lights, radio directional communication and landing facilities, and weather reporting services (in co-operation with the Weather Bureau). It

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[52]"Report of the Committee on Mapping Services," op. cit., p. 192.

[53]Ibid., p. 193.

compiles flight checks and publishes air navigation maps in cooperation with the Coast and Geodetic Survey of the same department. The Bureau is also a clearing-house for information on all matters pertaining to civil aeronautics.[54]

Inasmuch as the Bureau does not itself engage in surveying or mapping activities but has its maps compiled by the Coast and Geodetic Survey, these maps have been dealt with in the section devoted to the Survey.

BUREAU OF THE CENSUS

The Bureau of the Census, of the Department of Commerce, in order to supply enumerators in the field with outline base maps of the districts they are to cover, and in order to portray census statistics geographically, compiles a large series of outline maps showing administrative subdivisions (counties, townships and other minor civil divisions) of the country as a whole and of the separate states.[55]

The Bureau does not itself engage in field surveying or mapping of the ordinary type and maintains no map reproduction plant. It depends largely on counties and cities for detailed maps which are photographed or photostated for the Bureau's use. It compiles only outline maps showing political divisions for administrative uses of the Bureau itself. The data plotted by the Bureau on these outline maps make of the latter what are in effect statistical charts or diagrams. A list of these chart publications is included in the appended reference list of United States government maps and map sources.

BUREAU OF FOREIGN AND DOMESTIC COMMERCE

The Bureau of Foreign and Domestic Commerce, in the Department of Commerce, plots data in various forms, including diagrammatic maps, in order to portray trade and other statistical data. As a basis for this work the Bureau has compiled a series of outline base maps in black and white appropriate for its needs. With these base maps available, the present map work of the Bureau is practically confined to the plotting of statistical data. It does not appear that these maps are for publication.[56]

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[54] United States Government Manual, 1935, p. 110.

[55] "Report of the Committee on Mapping Services," op. cit., p. 214.

[56] Ibid., p. 215.

NATIONAL PARK SERVICE

The National Park Service, in the Department of the Interior, exercises administrative supervision over 24 national parks, 1 national historical park, 67 national monuments, 11 national auxiliary parks, 11 national cemeteries, 10 battlefield sites, 4 miscellaneous memorials, 8 memorial projects, all public parks in the District of Columbia, and certain public buildings both within and without the District.[57]

An Engineering Branch is maintained by the Service for minor road construction and the preparation of plans for other miscellaneous engineering activities. Work required in connection with major roads is usually performed by the Bureau of Public Roads, of the Department of Agriculture. Surveys of park boundaries are generally executed by the General Land Office, of the Department of the Interior; and preparation and publication of topographic and other maps required by the Service are performed by the Geological Survey.

The Branch of Planning and Designs, which has the duty of planning the future national park and monument system, prepares landscape plans and designs buildings and other structures needed by the Park Service. It also compiles and drafts small maps illustrating published reports, and is presently issuing a small-scale "recreational map" of the country, showing location and area of national parks, national forests, national monuments, and Indian reservations. This map is printed for the Park Service by the Geological Survey.[58]

A list of the maps available from the Park Service is included in the appended reference list of United States government maps and map sources.

BUREAU OF AERONAUTICS

The functions of the Bureau of Aeronautics of the Navy Department are in many respects similar to those performed by the Army Air Corps for the Army (see the next section). No surveying or mapping is performed, however, though the Bureau engages in aerial photographic work for the Hydrographic Office and renders occasionally a similar service to other Federal mapping agencies.

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[57] United States Government Manual, 1935, p. 83.

[58] "Report of the Committee on Mapping Services," op. cit., p. 244.

Air navigation maps for coastal regions are compiled for the Bureau by the Hydrographic Office, Navy Department.[59]

U.S. ARMY AIR CORPS

The U.S. Army Air Corps of the War Department is not primarily a mapping organization although it compiles a certain number of maps required for the operation of aircraft and supplies aerial photographs for mapping performed by other Federal agencies. Its map compilation work is limited in amount and specialized in character, and its photographic work, although of high value for mapping as well as for other purposes, does not necessarily constitute a mapping activity.[60]

For the use of its flying personnel the Air Corps has published a series of 63 air navigation "strip" maps on the scale of 1:500,000. They cover air routes regularly used by Army pilots. It appears likely that no further additions will be made to this series. The Air Corps has also issued a few experimental maps on such small scales as 1:750,000 and 1:1,000,000. Drafting and printing of these maps is performed by the Corps of Engineers in the Engineer Reproduction Plant, at Washington, D.C.

It may be noted that the areas represented on the Army Air Corps' 63 strip maps are necessarily duplicated in the "sectional maps" prepared for the entire country by the Coast and Geodetic Survey at the request of the Aeronautics Branch of the Department of Commerce. A similar situation exists with respect to the aviation charts that have been issued, chiefly along coastal belts, by the Hydrographic Office of the Navy Department. Since the completion of the entire series of 87 "sectional" airway maps required to cover the whole country is expected from the hands of the Coast and Geodetic Survey in the course of the current year, the aerial maps and charts issued respectively by the Army Air Corps and by the Hydrographic Office must necessarily represent a certain amount of duplication.

MILITARY INTELLIGENCE DIVISION: GENERAL STAFF

The Military Intelligence Division in the War Department is charged with those duties of the General Staff which relate to the collection, evaluation, and dissemination of military information, including the preparation of plans, policies and

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[59] Ibid., p. 261. [60] Ibid., p. 271.

supervision of all activities connected with military topographical surveys, maps, and photographs.[61]

In pursuit of these functions the Military Intelligence Division compiles very small-scale maps (1:250,000; 1:1,000,000) of foreign regions, for military purposes.[62] It does not, however, engage in field surveying or mapping, and does not maintain a map reproduction plant. The maps compiled by the Intelligence Division cover foreign countries only. The military data shown on these maps are usually of such a nature as to require the maps to be kept confidential. A few of the maps have been made available, however, to the public. A list of these is included in the appended reference list of United States government maps and map sources. They are obtainable from the Superintendent of Documents, Washington, D.C.

BOARD OF SURVEYS AND MAPS
OF THE FEDERAL GOVERNMENT

The Board of Surveys and Maps, an independent government agency, was created in December, 1919, for the purpose of making recommendations to the several departments or to the President relative to the co-ordination of the map-making and surveying activities of the government, and to settle all questions at issue between executive departments concerned with surveys and maps, in so far as their decisions do not conflict with existing laws.[63]

The Board is composed of 23 members, each of whom is the representative of a government bureau or agency engaged in surveying or mapping activities. An advisory council, composed of representatives of 21 non-Federal organizations, clubs, associations, submits recommendations to the Board for consideration at its meetings and otherwise represents the map-using public in affairs of the Board. The meetings are held once a month.

It should also be noted that a central information office has been established in the United States Geological Survey for the purpose of collecting, classifying, and furnishing information concerning all map and survey data available in the various government departments and from other sources.

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[61] United States Government Manual, 1935, p. 29.

[62] "Report of the Committee on Mapping Services," op. cit., p. 290.

[63] United States Government Manual, 1935, p. 324.

## Report on a National Mapping Plan

One of the most significant achievements of the Board of Surveys and Maps is represented by its recent formulation of a comprehensive mapping plan designed to complete the topographic mapping of the entire country within a period of ten years. The plan has been published as a section of the Report on National Planning and Public Works in Relation to Natural Resources, which was issued by the Natural Resources Board, Washington, D.C., on December 1, 1934. Only about 48 per cent of the United States has thus far been mapped topographically, and of this percentage almost one-half is by now below the standards of accuracy and requires remapping. In order to bring about the rapid completion of the topographic mapping of the country, the Board recommends the extensive application of aerial photography and the compilation of maps therefrom differentiated in three series of field and publication scales, according to the types of land covered.

The series are as follows:

1st Series:

In this series are included all unmapped or inadequately mapped agricultural lands in the Eastern and Southern states where the boundaries of farms and fields are irregular in shape and most fields are relatively small. Areas of great economic importance are likewise included. For these the Board recommends the compilation of planimetric maps (i.e., maps prepared from aerial photographs, but without contours) on the scale of approximately 1:20,000. From these maps are to be derived preliminary sheets on the scale of 1:24,000, without contours, and then advance-sheets on the scale of 1:31,680, with contours. The final map sheets are to be on the standard scale of 1:62,500. The areas thus affected are estimated to comprise about 300,000 square miles.

2nd Series:

This series is to comprise unmapped and inadequately mapped areas of moderate economic importance and of relatively large-size farms and fields. For the mapping of these the Board recommends the compilation of planimetric maps from aerial photographs, on the scale of 1:31,680. These sheets are next to be provided with contours and to be published in advance-sheet form on the scale of 1:48,000. The final maps are to be issued on the standard scale of 1:62,500. About 1,216,000 square miles of territory are estimated to be comprised in this series.

3rd Series:

The third and last series covers unmapped and inadequately mapped areas of minor economic importance, such as mountain and desert areas. For these the Board recommends the compilation of base sheets by means of adequate aerial photography.

No preliminary maps are called for, though contour lines are directly to be added to the base sheets. These contoured sheets are to be published, first, in advance form on the scale of 1:96,000 and, then, in final form on the scale of 1:125,000.

In fine, the Board proposes a program calling for the rapid topographic mapping and remapping, by means of aerial photography, of mountain and desert regions on the scale of 1:125,000, and of the less rugged and more populous regions on the standard scale of 1:62,500. It is the belief of the Board that the systematic execution of this national mapping program would bring about topographic mapping of some 2,200,000 square miles of territory (inclusive of 740,000 square miles of territory to be resurveyed) now wholly unmapped or inadequately mapped, within a period of ten years and at a cost to the Federal government of approximately $117,500,000. It is to be a Federal project entirely.

It is not believed that positive steps have been taken as yet relative to the execution of this program.*

The descriptions given in the preceding pages of the various individual government mapping services may well be concluded with a brief recital of the functions of a Federal committee which, although not engaged in mapping activities of any sort, is nevertheless importantly related to a very significant aspect of map compilation, that is, the choice and spelling of geographic names.

ADVISORY COMMITTEE ON GEOGRAPHIC NAMES

The purpose of this Committee, in the Department of the Interior, is to decide "all unsettled questions concerning geographic names which arise in the Departments." These questions have to do chiefly with the choice and spelling of names presented by various government establishments. The first government agency of this nature was created by executive order of President Harrison, in 1890, as the "United States Board on Geographic Names." This title was shortened to "United States Geographic Board," in 1906. It was so continued until April 17, 1934, when by executive order of President Roosevelt the Board was abolished and its functions, personnel, and equipment transferred to the Department of the Interior. The activities of the former Board are now vested

*Note: A modified national mapping program was presented to the Senate by the Secretary of the Interior, January 29, 1937.

in the "Advisory Committee on Geographic Names" of that Department.[64]

Co-operating with and aiding the activities of the Board were a number of State Geographic Boards and an Advisory Committee of experts chosen from various parts of the country. Publication of the Board's decisions was made at monthly intervals. Cumulative reports of the Board's work and of its decisions were issued at longer intervals. The latest of these reports was published by the U.S. Government Printing Office in 1933. It is entitled Sixth Report of the United States Geographic Board 1890 to 1932, and gives a résumé of the Board's work and a full list of its decisions since its establishment in 1890. An unbound copy is available from the Superintendent of Documents, Washington, D.C., at the price of 80 cents.

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[64] "Report of the Committee on Mapping Services," op. cit., p. 216.

CHAPTER XI

# REFERENCE LIST OF MAP PUBLICATIONS ISSUED BY THE UNITED STATES GOVERNMENT

Note: This chapter lists or indicates the map publications made available by the bureaus and offices of each government department. The main arrangement is alphabetical, first, with respect to the departments and, next, with regard to the map issuing bureaus. It should also be noted that actual map titles, as distinguished from descriptive ones, are written with initial capitals.

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## AGRICULTURE, Department of

### Atlas of American Agriculture

Pt. I. Physical Basis of Agriculture. Section E: Natural Vegetation: Grassland and Shrubs (1924). Pp. 29

Pt. II. Climate. Section I: Frost and Growing Season (1918). Pp. 14

Pt. II. Climate. Section A: Precipitation and Humidity (1922). Pp. 48

Pt. II. Climate. Section B: Temperature, Sunshine, and Wind (1928). Pp. 34

Pt. III. Soils of the United States (1935). Pp. 98

Pt. V. The Crops. Section A: Cotton (1918)

Pt. IX. Rural Population and Organizations. Section I: Rural Population (1919)

### Atlas of American Agriculture; Physical Basis, including: Land Relief, Climate, Soils, and Natural Vegetation of the United States. (1936). Prepared under the supervision of O. E. Baker.

Bibliographical Aids

The sections of this atlas are individual contributions by bureaus in the department. They were first published as "advance sheets" at the dates indicated, and are now included, except the sections on Cotton and on Rural Population, in the definitive one-volume edition of the atlas listed below.

The scope of this final edition of the atlas has been purposely confined to the portrayal of the physical conditions of agriculture. For graphic data on crops, livestock, size of farms, systems of farming, land utilization, farm tenancy, rural organizations and population, see the Yearbooks of the Department of Agriculture, especially for the years 1921-25, and the Graphic Summary of American Agriculture, noted further on.

The atlas and the individual atlas sections are obtainable from the Superintendent of Documents, Washington, D.C.

This final edition of the atlas is composed of the first five sections listed in the preceding entry, and of one new item dealing with Land Relief (6 pages; 1936).

AGRICULTURE, Department of (Cont.)

Bibliographical Aids

Outline maps of the United States indicating counties, June 1, 1840--March, 1920

(1921. Nine maps, each 21.2 x 33.1 in.; the set is styled "Historical Series of Maps." Outlines and names of counties are shown in blue.)

This set of historical outline maps is available from the Superintendent of Documents at the price of one dollar and fifty cents.

Agricultural Economics, Bureau of

County Outline Map of the United States (Jan. 1, 1935)

(Scale 300 mi. to 2.6 in., or 1:7,500,000; size 16.1 x 25.8 in.; county outlines in black.)

County Outline Map of the United States (Jan. 1, 1935)

(Scale 300 mi. to 3.9 in., or 1:5,000,000; size 24.2 x 38.6 in.; county outlines in blue.)

The two outline maps are listed in Price List 53 and are obtainable from the Superintendent of Documents. The price of the first map is ten cents, that of the second, ten cents.

Note: For outline maps issued by other government agencies see the heading "outline maps" in the index.

Graphic Summary of American Agriculture....(Miscellaneous Publication No. 105; May, 1931)

(Compiled by O. E. Baker, and based largely on the Census. This publication depicts graphically, by means of small outline maps and dots and shading, agricultural distribution phenomena and trends.)

Obtainable from the Superintendent of Documents.

See also the Yearbooks of the Department of Agriculture especially for the years 1921-25; and also the Atlas of American Agriculture.

Land-Use Areas. Natural land-use areas of the United States. Map with explanatory text

(1933. Scale 1:4,000,000; size 30.7 x 48.8 in. An outstanding map listing, according to physical character, about 272 natural areas.)

The map is listed in Price List 53 and is for sale by the Superintendent of Documents at the price of fifty cents.

| AGRICULTURE, Department of | Bibliographical Aids |
|---|---|
| Agricultural Economics, Bureau of (Cont.) | |
| Type-of-Farming Areas of the United States (1933) (Map of)<br>(Scale 1:8,000,000; size 30 x 41.1 inches; in colors. An important map prepared co-operatively with the Census Bureau. It indicates no less than 514 areas on the basis of the 1930 Census.) | See Price List 53: Maps, (June, 1936). The map is for sale by the Superintendent of Documents, Washington, D. C. |
| Value of Farm Land and Buildings per Acre in the United States (Map of)<br>(The map is based on the 1930 Census; scale 1:5,000,000; size 23.8 x 38 in.) | Obtainable from the Superintendent of Documents. The map also gives annual state indexes of value of farm lands and buildings since 1930. |
| Outlook Charts<br>(These charts, which also include a few maps, show the economic outlook with respect to certain agricultural products.) | A mimeographed "List of Agricultural Outlook Charts" is issued annually by the Bureau and is obtainable on request. |
| Note: Numerous small maps are also included with the Bureau's many serial and other publications. | As a check on these publications, see the Bureau's monthly serial entitled Agricultural Economics Literature. |
| Animal Industry, Bureau of | No map list is issued by the Bureau; but see Price List 53: Maps, or apply directly to the Bureau. |
| The following maps are prepared by this Bureau: | |
| Maps of infected districts: | |
| Cattle Tick-Fever map (Issued annually) | |
| Map showing status of tuberculosis eradication (Issued bi-annually) | |
| Small outline maps showing extent of animal diseases, parasites, prevalence of stock poisoning plants, etc. | |

AGRICULTURE, Department of (Cont.)

Bibliographical Aids

Chemistry and Soils, Bureau of

The Bureau has issued approximately 1200 large colored soil maps, each of which shows the kinds of soil of a particular area or county surveyed. Detailed soil surveys have been completed for about one-half of the land area of the country.

A complete list of the counties and areas for which soil maps are available is contained in Price List 46, which is obtainable free from the Superintendent of Documents.

An index map showing the present status of the detailed and reconnaissance type of soil survey which have been made by the Bureau is included in Part III of the Atlas of American Agriculture; see also the note on page 138, preceding.

Forest Service

Forest Regions of the United States [map], with a list of the principal trees of each region....

(1933. 1 sheet.)

Price List 43, entitled "Forestry," lists all of the Forest Service publications which may be purchased from the Superintendent of Documents.

Map of National Forests, State Forests, National Parks, Monuments, Indian Reservations

(1936. Scale 1:7,000,000. Perhaps obtainable free from the Service.)

It should be observed that no comprehensive maps are as yet available for the present total of approximately 145 national forests. The boundaries of the national forests are frequently changed for one reason or another, and information regarding a particular forest is therefore best solicited from the Service.

Planimetric maps of the national forests, on the scale of 4 and 2 miles to 1 inch are also compiled by the Service. See the descriptive notes on page 141, preceding.

An index map showing the general location of the national forests, purchase units, and other Federal and state reservations is also obtainable from the Service.

A small folder is available giving names and addresses of The National Forests and Field Offices of the U.S. Forest Service.

An Area Table indicating the latest changes in boundary of all the national forests is published from time to time by the Service.

AGRICULTURE, Department of — Bibliographical Aids

Public Roads, Bureau of

Atlas of Federal-Aid Highway System

(October, 1932. The atlas covers the United States in 18 sheets, each 22 x 23 in. in size; one index chart. The scale of the maps varies somewhat with the number and size of the states shown on each sheet, but all were compiled on the General Land Office base map on the scale of 37 mi. to 1 in.)

The bureau's current maps are listed in various editions of Price List 53, and also in the Monthly Catalog of United States Public Documents.

Progress maps of Federal-aid highway system

(Each state is covered by a map. Some maps consist of two or more sheets, and their total for the entire country is 112. They are of uniform size and may be fitted in a loose-leaf atlas. The scale is 1:500,000 for the states east of the Rocky Mountains, and 1:760,320 for states farther west.

The maps show the status of improvement of the Federal-aid system in each state, regardless of the particular government agency responsible for the improvement. Revision of the maps is made individually by states. They are printed by the United States Geological Survey.)

A complete list of these maps, with prices and dates of their latest revision, may be found in the current edition of Price List 53, obtainable from the Superintendent of Documents.

United States Systems of Highways (Map of)

(Corrected to July 1, 1935; scale 100 mi. to 1.3 in.; size 25.2 x 39.3 in.)

United States Systems of Highways....(Map of)

(1927. Scale 37 mi. to 1 in., two sheets, each 59.5 x 41.5 in. The map shows the system of uniform highway marking adopted Nov., 1926, by state and Federal governments.)

| | Bibliographical Aids |
|---|---|
| AGRICULTURE, Department of | |
| Public Roads, Bureau of (Cont.) | |
| Transportation maps 1:250,000<br><br>The following sheets are available:<br><br>Florida (1935; 12 sheets)<br>Iowa (1934; 8 sheets)<br>Maine (1935; 6 sheets)<br>New Hampshire (1935: 2 sheets)<br>Vermont (1935; 2 sheets) | Note: This is a new undertaking. Transportation maps will be issued for every state in the Union. The sheets are uniformly 26 x 36 in. in size and cover the states in rectangular areas 90 x 130 miles in extent. The maps are colored and show railroads, highways, canals, air lanes, dredged channels, and pipe lines. It will take about two or three more years to complete the map. It is obtainable from the Superintendent of Documents. See Price List 53 for published map sheets and prices. The list given here covers publication through June, 1936. |
| Soil Conservation Service | |
| Reconnaissance erosion survey of the United States (Map)<br><br>(1935. Scale 1:5,000,000; size 24.1 x 39.6 in.) | Map is obtainable from the Superintendent of Documents. See also pages 141 and 337 for mention of further mapping performed by the Service. |
| Weather Bureau | |
| Daily Weather Map<br>Monthly Weather Review<br>Climatological Data for the U. S. by sections | Obtainable through the Superintendent of Documents. |
| COMMERCE, Department of | |
| Census, Bureau of the | |
| Maps of minor civil divisions and names of incorporated places<br><br>(1934. These maps, one to a state, are based on 1930 Census data; they are mostly on the scale of 40 mi. to 2.5 in. though the map sheets are of various sizes.) | A list of these maps appears in Price List 53 |
| Statistical Atlas of the United States based upon results of the Census<br><br>(Such atlases were published for 1870 and 1890 through 1920; the maps show such Census data as density of | Note: A "Scribner Atlas" containing Census data for 1880 was privately published by Charles Scribner's Sons. |

COMMERCE, Department of

Census, Bureau of

Statistical Atlas . . . (Cont.)

population, distribution and yield of crops, areas irrigated, etc.)

Coast and Geodetic Survey

Aeronautical charts, Regional

(Scale 1:1,000,000; size about 33 x 50 in., covering an area within 6° latitude by 12° longitude. A day-flying and a day and night-flying edition are issued. Only two charts of each edition have thus far (July 1937) been published of the 17 charts required to cover the whole United States.)

Aeronautical charts, Sectional

(Scale 1:500,000; size about 20 x 42 in., covering an area within 2° latitude by 6° longitude. The 87 charts required to cover the United States were completed in 1936.)

Aeronautical Planning Chart

(1935. Shows principal cities, airports, and radio broadcasting stations. Scale 1:5,000,000; size 26 x 40)

Note: See also the air navigation charts issued by the Hydrographic Office, Navy Department.

Alaska

Charts, see Nautical charts

Map of Alaska

(Lambert conformal projection; scale 1:5,000,000; size 18 x 27 in.)

Maps of Alaska showing astronomic stations have appeared in reports of the Survey since 1913 and through 1931, except for 1915. (See Price List 53.)

Bibliographical Aids

Note: United States and individual state maps showing various aspects of Census data have been included in Census Reports since 1870. Various series of outline maps showing administrative subdivisions have also been prepared by the Bureau.

All of the Survey's chart publications are listed in its detailed Catalog of U.S. Coast and Geodetic Survey Nautical and Aeronautical Charts, Coast Pilots, Tide Tables, Current Tables, Tidal Current Charts, which is issued annually and is obtainable free from the Survey and its authorized agents. The July 1937 edition of the catalog contains 62 pages of key index charts and chart lists.

For the publications covering the Survey's activities in hydrography, tides, currents, geodesy, terrestrial magnetism, and seismology, see the general List of Publications of the Department of Commerce, published annually and obtainable free from the "Division of Publications, Department of Commerce. The July 1937 issue contains 142 pages.

For recent additions or revisions of aeronautical charts, see the monthly one-sheet circular with index chart which is published by the Survey. For those desiring prompt notification of new chart publications the Survey maintains a mailing list (No. 109-R).

The Survey and its field agencies are the sole distributors of the chart publications. The Survey's other publications, as included in the Department of Commerce list, except the United States coast pilots and intracoastal waterways pilots, are available only from the Superintendent of Documents.

COMMERCE, Department of

Coast and Geodetic Survey (Cont.)

| | Bibliographical Aids |
|---|---|
| Base maps, Outline<br>(Single sheet maps, mostly on the scale of 1:5,000,000, have been issued of Alaska, the North Atlantic, the North Pacific Oceans, and the United States.<br>Also available are a number of line maps without contours, compiled from aerial photographs on scales of 1:10,000 and 1:20,000 in connection with revision surveys of the coast.) | The single maps are listed in the Survey's catalog and also in the Department's list of publications--both noted on the preceding page.<br><br>Information respecting the line maps must be solicited from the Survey directly. An index for each region for which these maps are available is issued free. |
| Geodetic control survey index maps<br>(A map is available for each of the 48 states.) | These maps as well as the charts listed next, are obtainable only from the Survey and its authorized agencies. |
| Miscellaneous chart publications (Great circle chart; Magnetic chart, etc.) | |
| Nautical charts; sailing charts; charts of the coasts and harbors (United States and dependencies)<br>Alaska<br>Atlantic coast<br>Guam<br>Gulf of Mexico<br>Pacific Coast<br>Panama Canal Zone<br>Philippine Islands<br>Puerto Rico<br>Samoa<br>Virgin Islands | All these charts are listed and marked on key index charts in the Survey's catalog, as noted on the preceding page.<br><br>Separate index charts of local areas are also obtainable.<br><br>New charts, new editions of charts and new publications are currently announced in the weekly leaflet, Notice to Mariners; it is available free. |
| Intracoastal (inside route) waterways charts<br>New York to Key West | Photographic copies of the large scale field surveys from which the charts are compiled, can be had from the Survey at the coast of reproduction. |
| Tidal current charts<br>Boston Harbor<br>New York Harbor<br>San Francisco Bay<br>Long Island Sound and Block Island Sound | Note: For charts of the Great Lakes and connecting waters, see U.S. Lake Survey Office, War Department.<br>For Charts of the principal river and harbor systems of the United States and dependencies, consult the index at the end of the volume.<br>For charts of the oceans and foreign waters, see under Hydrographic Office, Navy Department. |
| Philippine Islands<br>Airway maps (3 maps)<br>Base map (1:5,000,000)<br>Coast and pilot charts<br>Outline map (1:2,500,000)<br>Topographic maps (17 maps; scale 1:200,000) | |

| | Bibliographical Aids |
|---|---|
| CONGRESS, Joint Committee on Printing | |
| Maps of Congressional Districts | These maps are included in the Official Congressional Directory, which is for sale by the Superintendent of Documents. |
| FEDERAL COMMUNICATIONS COMMISSION (Note: Previous to July, 1934 the Commission was called Federal Radio Commission.) | |
| Map of Inspection Districts and Amateur Radio Call Areas; United States and dependencies. (1934. Scale 1:5,000,000) | The map is obtainable from the Secretary of the Commission. |
| FEDERAL POWER COMMISSION | |
| Map No. 1: Service Areas of the Principal Electric Utility Systems of the United States (Scale 1:2,500,000; size 51½ x 80 in. Distribution of about 65 major utility systems and 600 operating companies is shown, representing nearly 90%, by volume, of the entire industry.) | The two maps were issued in 1935; they are for sale by the Federal Power Commission, Washington, D.C. A 4-page descriptive folder is obtainable free from the Commission. |
| Map No. 2: Principal Generating Plants and Electric Transmission Lines of the United States (Scale 1:2,500,000; size 57½ x 84 in. Map shows location of about 345 hydroelectric plants and 709 fuel generating plants; 135,000 circuit miles of transmission lines are also shown, including all lines of 60,000 volts and over.) | |
| INTERIOR, Department of the | |
| General Land Office | |
| Maps of the public land states (The maps are on the scale of 12 miles to the inch, except for Alaska. Revised editions are published whenever the progress of the surveys, or some administrative purpose warrants it. The | See Price List 53 for available editions of these maps.<br><br>A complete list of the maps, printed on one side of a postcard, is obtainable from the General Land Office. However, the maps are purchasable only |

INTERIOR, Department of the — Bibliographical Aids

General Land Office (Cont.)

Maps of the public land states

maps show principal cities, county boundaries, national parks and monuments, Indian, military, bird and game reservations, national forests, railroads, canals and other details, but they do not show the vacant public land. The more recent maps show, in addition, land district boundaries. The maps serve also as index charts to the township plats of public land states.)

from the Superintendent of Documents. The cost of each map is twenty-five cents.

Outline map of United States

(1936. Scale 250 mi. to 3.9 in.; size 30.2 x 45 in.)

The map may be purchased from the Superintendent of Documents for twenty-five cents.

Township plats of government surveys

(These photolithographic plats are scaled two inches to the mile, with each plat measuring about 19 x 24 inches and covering one township. They show land lines and general topography in townships six miles square and fractions thereof.)

No special list is available for these plats, but the maps of public land states, noted above, serve as index charts to their identification.

Surveys have been completed (July, 1937) in 18 of the 29 public land states; they are: Alabama, Arkansas, Florida, Illinois, Indiana, Iowa, Kansas, Louisiana, Michigan, Minnesota, Mississippi, Missouri, Nebraska, North Dakota, Ohio, Oklahoma, South Dakota, and Wisconsin.

The original plat, with field notes, is filed in the proper state or in the United States Public Land Office. A copy is purchasable from the General Land Office.

United States, Map of, including Territories and insular possessions

(1936. Scale 37 mi. to 1 in.; size 59.5 x 82.3 in. The map shows features similar to those of the state maps noted above. A new edition is issued when changes demand it.)

For the large map of the United States and dependencies, noted in the adjoining column, see Price List 53, where a complete list of the numerous insets which accompany the map is given. The map is obtainable from the Superintendent of Documents, for two dollars.

Note: The General Land Office has on file copies of the state maps which were issued at irregular intervals, beginning with the map of Ohio, issued in 1886 and embracing all maps of public land states so published up to and including the current state maps mentioned above. This historical file contains also

INTERIOR, Department of — Bibliographical Aids

General Land Office (Cont.)

various miscellaneous maps and plats relating to public land other than the regular township plats. Photostat copies of the maps and plats in this file may be purchased from the Land Office.

Geological Survey

Geologic Atlas of the United States

(This atlas is made up of so-called "Geologic Folios," each folio covering one or more quadrangle areas. Each quadrangle is named after some city, town, or prominent landmark in the quadrangle area. Some 225 geologic folios have been published thus far.)

For a) geologic folios, consult Publications of the United States Geological Survey. This is a comprehensive catalog of the Survey's publications, except its topographic maps. The latest edition (March, 1937) lists all but one of the folios published thus far. The catalog is revised at intervals of a year or two and is obtainable free from the Director of the U. S. Geological Survey, Washington, D. C.

Geologic Folios

(See above under Geologic Atlas . . . .)

Topographic maps

(These map sheets form part of the standard topographic map of the United States, 47.1% of which had been completed by June 30, 1937. The most commonly employed scales for these sheets are: 1:62,500, 1:31,680, and 1:125,000. The map sheets are identified with quadrangle areas in the same manner as was noted above in connection with the Geologic Atlas. The map sheets on the scale of 1:62,500 measure about 16 1/2 by 20 in. and cover a quadrangle area of 15 minutes longitude and latitude, or approximately 13 miles by 17 miles.)

For b) topographic maps and geologic folios, see the Survey's index charts known as Index Circulars. These index charts usually cover one or two states and show the quadrangles for which topographic maps and geologic folios have been issued or are in press. Revised charts are issued from time to time and may be obtained from the Director of the Survey.

For c) recent additions to geologic folios and topographic maps, etc., see the Survey's Monthly Announcements of New Publications. (Note: The issue for March, 1935, was List 325.) This leaflet is obtainable free from the Survey.

| INTERIOR, Department of | Bibliographical Aids |
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| Geological Survey (Cont.) | |
| Miscellaneous Map Publications | See the comprehensive catalog mentioned under (a) on the preceding page. |
| Geologic Map of the United States<br>(This outstanding map was published by the Survey in 1933 on the scale of 1:2,500,000. It will be revised and reissued from time to time.) | |
| Map of the World on the Millionth Scale<br>(Only four sheets have thus far been completed of the United States' portion of this international map.) | See the circular entitled International Map of the World, obtainable from the Geological Survey; also Price List 53 |
| World Atlas of Commercial Geology<br>(This atlas, in two parts, was published in 1921. Part I shows the supply and distribution of essential minerals, and Part II shows the same for water power. Both parts are out of print.) | See the catalog mentioned under (a) on the preceding page. |
| Various base, contour, and other maps of the United States and of the states are available. | See the above-mentioned catalog and also the index circulars noted under (b) on the preceding page. |
| Note: Many individual maps are included with the monographs, professional papers, bulletins, and water-supply papers published by the Survey. These maps are not recorded separately, except the geologic maps. | A list of the maps, arranged by states, is included in the Bibliography of North American Geology, which is published from time to time in the series of Geological Survey Bulletins listed in the catalog mentioned under (a) on the preceding page.<br>Note also the recommendations made by the Board of Surveys and Maps for the early and systematic completion of the standard topographic map of the United States. The recommendations form Part V of the National Resources Board Report published Dec. 1, 1934, by the Superintendent of Documents. A Topographic Index Map of the United States, showing the quadrangle areas that have been |

| INTERIOR, Department of | Bibliographical Aids |
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| Geological Survey (Cont.) | |
| | adequately mapped thus far, is included in the report. |
| Indian Affairs, Office of | |
| Maps of various Indian reservations<br>(These maps are outline drainage maps. They show very complete detail of culture and land divisions. They have been issued and revised since 1910 and are for administrative purposes only.) | No list is issued for these maps since they are not issued for publication. |
| National Park Service | |
| Maps of the following national parks:<br>Acadia (Maine)<br>Carlsbad Caverns (New Mex.)<br>Crater Lake (Oreg.)<br>General Grant (Cal.)<br>Glacier (Mont.)<br>Grand Canyon (Ariz.)<br>Grand Teton (Wyo.)<br>Great Smoky Mountains (N. C.--Tenn.)<br>Hawaii<br>Hot Springs (Ark.)<br>Lassen Volcanic (Cal.)<br>Mesa Verde (Colo.)<br>Mt. McKinley (Alaska)<br>Mt. Rainier (Wash.)<br>Platt (Ark.)<br>Rocky Mountain (Colo.)<br>Sequoia (Cal.)<br>Wind Cave (S. C.)<br>Yellowstone (Wyo.--Mont.--Idaho)<br>Yosemite (Cal.)<br>Zion and Bryce Canyon (Utah) | The various maps available for these parks are included with the individual circulars of General Information . . . . which are issued annually by the National Park Service for each of these parks. The circulars are obtainable free from the Service. |
| Maps issued singly:<br>Eastern National Park-to-Park Highway (Map of)<br>(Revised to June, 1934)<br>Great Smoky Mountains National Park (Map of)<br>(A preliminary base map revised to July 2, 1934) | These single maps, some of which are corrected from year to year, are obtainable from the National Park Service. No special list of them is issued. |

INTERIOR, Department of

National Park Service

Maps issued singly: (Cont.)

Bibliographical Aids

See note on preceding page.

Mather Memorial Parkway in Mount Rainier National Park (Map of)

(Edition of Jan. 8, 1929)

Motorist guide maps of:

Crater Lake, Glacier Mount Rainier, Rocky Mountain, and Yosemite national parks

These maps are kept up to date and re-issued in January of each year.

A list of five additional maps is given in the Monthly Catalog United States Public Documents (July 1937), p. 916.

Recreational Areas of the United States (Map of)

(The map is corrected from year to year; the last issue of May 1, 1934, is on the scale of 1:4,750,000. It shows direct highways to all of the national, historical, and military parks, monuments, battlefield sites, national cemeteries, state parks, national forests, Indian reservations, etc.)

Recreational maps (by states)

(These maps, issued in 1934, were rotoprinted for the following states: Alaska, Florida, Idaho, Maryland, Montana, New Jersey, Oregon, Tennessee, Utah, Wyoming, and the Territory of Hawaii.)

For details about these maps see the Monthly Catalog United States Public Documents for Sept., 1934, p. 201.

Shenandoah National Park (Map of the Proposed)

(The map shows highway connections; it was issued in 1933.)

Shenandoah National Park (Topographic map of) (1933)

Small skeleton map of the United States showing locations of national, historical and military parks, etc. (Jan. 1, 1935)

INTERIOR, Department of (Cont.)

Reclamation, Bureau of

Various irrigation project maps and plats:

Boulder Canyon project maps

(The Ariz.-Cal.-Nev. sections are covered by the maps.)

Large project maps

(The maps show topography and irrigation canals; they are on the scale of 2 miles to the inch.)

Small project maps

(These maps show canals and irrigable areas in individual reclamation states.)

Special project maps

(These maps show irrigation canals and laterals.)

Special maps

Farm-unit plats

(These are maps of townships on the scale of 2 inches to the mile; they form the official record to which homestead entries and water-right applications must be made to conform.)

Town-site Plats

Note: Photostat copies are available of certain maps and profiles showing physical conditions; these are not for publication but are kept on file by the Bureau.

Bibliographical Aids

Note: The Bureau is the sole distributing agency for all of its publications.

For a current list of the Boulder project maps, see the special 2-page mimeographed price-list of Boulder Canyon Project publications issued by the Bureau on August 1, 1934.

For specific data on all the publications of the Bureau, including its maps, charts, and plats, issued to date, consult:

1) For publications issued up to 1920: "List No. 5," of Publications of the United Reclamation Service. This list was issued in 1920. It is out of print, but may be consulted in depository libraries.

2) For publications issued between 1920 and June, 1933: "Price-List No. 9," of Publications of the Bureau of Reclamation. This list was issued in 1933 and is obtainable from the Bureau.

3) For current additions: See the latest issues of the Monthly Catalog United States Public Documents.

Note: A list of plats by township and range for any of the farm-unit plats contained in the above price-lists is obtainable on request from the Bureau of Reclamation.

NAVY DEPARTMENT

Hydrographic Office

Aviation charts

(These are strip charts of the coast lines of the United States, Central America, the West Indies, and the Hawaiian Islands. More than 60 different charts have been issued to date.)

Nautical charts

(These charts, numbering about 3,000, cover primarily foreign waters and foreign coast lines. Only a few general charts of the United States coast are published by the Office. For detailed charts of the United States coast, see under Coast and Geodetic Survey, Department of Commerce.)

Pilot charts

(Issued monthly or quarterly for individual oceans.)

Sailing directions

(These are issued annually, in book form, and corrected to Jan. 1 of year published.)

World charts

(These include various base and outline charts of the world, and also charts of compass variations, magnetic inclination, communication, great circle distances, and time zones.)

Note: For charts of the United States coasts of the Great Lakes, see under War Department, Great Lakes Division, U. S. Lake Survey Office.

For coast, harbor and sailing charts of the United States and Possessions, see under Department of Commerce, Coast and Geodetic Survey.

Bibliographical Aids

Note: The charts and other publications issued by the Hydrographic Office are obtainable only from this office or from its authorized agents, a list of which is appended to the catalog noted below.

All charts issued by the Hydrographic Office are listed in its elaborate General Catalog of Mariners' and Aviators' Charts and Books published by the Hydrographic Office (U. S. Government Printing Office, Washington, 1935).

This latest edition of the catalog is corrected to Jan., 1935, and replaces the previous edition of 1931. Some 30 index charts, including one for aviation, supplement this catalog which is obtainable free from the Hydrographic Office by those in need of it.

Note: For the latest information about new and revised editions of charts, sailing directions, light lists, etc., consult the Hydrographic Office's Notice to Mariners, Hydrographic Bulletin, and Notice to Aviators.

As one example of these charts may be cited the Communication Chart of the World, a 10th edition of which was issued in February 1937. It is in three sheets, each 38 x 26.9 in. in size, with a scale of 1° longitude equal to 0.2 in. The chart shows submarine cables, principal land lines and radio traffic stations. It is obtainable from the Hydrographic Office at 40¢ the sheet.

POST OFFICE DEPARTMENT

Bibliographical Aids

Topography Division

Domestic Air Mail Map

(This is an outline map of the United States, drawn to scale, showing states, domestic air mail routes and cities thereby served. No regular date is set for a new edition. The current issue is dated July 1, 1934.)

This map may be obtained free on request from the Second Assistant Postmaster General, Post Office Department, Washington, D. C.

Post route maps

(These are planimetric maps drawn on a polyconic projection to scales varying from 1.6 miles to 40 miles to the inch. Each map covers one state or territory, though with some exceptions. The maps show the location of all post offices, mail route mileage, county names and boundaries, principal drainage features, but no highways, and only such railroads as carry mail. New editions of the maps are issued about once a year or when new surveys make it necessary.)

For these maps see the printed one-sheet Price List of Post Route Maps obtainable, as well as the maps, from the Disbursing Clerk, Post Office Department, Washington, D. C., and also from the Office of the Fourth Assistant Postmaster General, Division of Topography.

See also the post route maps which are being made available by state highway departments, as noted on page 322.

Rural delivery county maps

(These are planimetric maps based on topographic surveys drawn, with a few exceptions, on the scale of either 1:62,500 or 1:63,360. They are in two colors. Complete maps are on file for 1495 counties in the United States, and additional county maps are prepared from time to time. They show, in addition to the roads traveled by rural carriers, all post offices within the county and all other roads, houses, schools and churches known at the time the maps were originally drawn. Drainage is outlined, but no contours are shown.

A special mimeographed "Price List of Rural Delivery County Maps" is obtainable for these maps from the Disbursing Clerk, Post Office Department, Washington, D. C.

Note: Since the above notes were written, the Post Office has issued a single, printed list, entitled Official Postal Maps. It is obtainable from Disbursing Clerk, Post Office Department. It replaces the previous lists.

POST OFFICE DEPARTMENT

Topography Division

Bibliographical Aids

Rural delivery county maps (Cont.)

No regular editions of these maps are issued, and the original drawings are kept up to date only with respect to routes used by rural carriers. Negatives of these maps are prepared as required, usually about once a year; and blue-line prints made therefrom are furnished to the public unless blue-print copies showing the latest rural delivery services are specifically requested.)

See note on preceding page.

Rural delivery "local center" maps

(These are sketch maps based on surveys or sketches drawn generally to the scale of 1:62,500 or 1:63,360, though a few of the maps are on scales ranging from 1/2 mile to 2 1/2 miles to the inch. Approximately 6,700 such "local center" maps have been issued for areas for which county maps have not been drawn. They show roads traveled by rural carriers on routes emanating from separate post offices. Corrections of original drawings are made whenever necessary for rural routes, but not for culture. Only blueprints are made of these drawings which are always up to date, and such prints may be obtained by request.)

No list of these "local center" maps is issued. But the maps are available at the price of 25¢ per map from the Disbursing Clerk, Post Office Department, Washington, D. C.

SMITHSONIAN INSTITUTION, Washington, D. C.

Bibliographical Aids

Storm frequency maps of the United States

See the Institution's Publication No. 3188 (March, 1933).

Note: Many occasional maps accompany the large number of publications for which the Institution is responsible. No special list is available for these maps, but some of them are noted in the List of Publications of the Bureau of American Ethnology (U. S. Government Printing Office, Washington, D. C., 1932). The list has been revised to Dec., 1932, and is obtainable from the Secretary of the Smithsonian Institution.

STATE DEPARTMENT

International Boundary Commission, United States, Alaska, and Canada. United States Section

Chart covering the boundary through the Straits of Georgia, Haro, and Juan de Fuca (1921)

(Scale 1:200,000; size 28 x 41 inches. Price 50¢)

Maps covering the boundary between Alaska and Canada along the 141st Meridian from the Arctic Ocean to Mount St. Elias (1918)

(38 maps; scale 1:62,500; size 18 1/2 x 27 3/4 inches. Price 25¢ the sheet)

Maps covering the boundary between Alaska and Canada from Mount St. Elias to Dixon Entrance

(13 maps; scale 1:250,000; size 25 x 29 inches. Price 50¢ the sheet)

The list of boundary maps as detailed in the adjoining column was especially compiled by the Commission for this undertaking and was received from it in a letter dated May 25, 1935. No other list of the Commission's map publications is available. *

All the maps listed here are purchasable from the Commission at the prices indicated.

Note: The dates of publication which are shown with some of the maps are those of the reports with which the maps were respectively issued.

Note: Sheets 1 and 2 of this series and the report on this section of the boundary have not yet been published, i.e., May, 1935.

*But see also Samuel F. Bemis and Grace G. Griffin, Guide to the Diplomatic History of the United States, 1755-1921 (Washington: Government Printing Office, 1935). See especially pages 66, 287, 415-23.

STATE DEPARTMENT

Bibliographical Aids

International Boundary . . . .
(Cont.)

Maps covering the boundary along the 49th parallel from the Gulf of Georgia to the northwesternmost point of Lake of the Woods.

(59 maps; scale 1:62,500; size 15 x 30 inches. Price 25¢ the sheet)

Maps covering the boundary from the northwesternmost point of Lake of the Woods to Lake Superior (1931)

(36 maps, some on the scale of 1:6,000 and others on 1:24,000 or 1:62,500; size 26 x 39 inches. Price 50¢ the sheet)

Maps covering the boundary from the St. Lawrence River to the source of the St. Croix River (1924)

(61 maps, some on the scale of 1:6,000 and others on 1:12,000 or 1:24,000; size 26 x 38 inches. Price 50¢ the sheet)

Maps covering the boundary from the source of the St. Croix River to the Atlantic Ocean (1934)

(18 maps, some on the scale of 1:6,000 and others on 1:12,000 and 1:24,000; size 26 x 38 inches. Price 50¢ the sheet)

Note: The report on this section of the boundary has not yet been published, i.e., May, 1935.

International Boundary Commission, United States and Mexico.
American Section, El Paso, Texas

A. General Boundary Map of the United States and Mexico:

General map of the country west of the Mississippi

(Scale 1:6,000,000)

The list of maps detailed in the adjoining column and the reference items indicated below were obligingly supplied for this undertaking by the Commissioner of the American Section of the Boundary Commission. The list is selective and represents only such of the Commission's map publications as may best serve the purpose of this paper. The date of the list, as furnished

STATE DEPARTMENT

Bibliographical Aids

International Boundary . . . .

A. General Boundary Map . . . . (Cont.)

Maps of the boundary line

(4 maps; scale 1:600,000)

by the Commissioner, is June 4, 1935. No other map list is available.*

The general map and the four boundary-line maps noted in the adjoining column form part of the Report of William H. Emory, Major First Cavalry and U. S. Commissioner (House Exec. Doc. 135, 34th Congr., 1st Sess., 2 vols., Washington, D. C., 1857).

Joint map of the survey covering the boundary from the Rio Grande to the Pacific Ocean

(A map of 19 engraved sheets, on the scale of 1:60,000. They show the topography of a belt of territory 5 miles wide.)

The map is part of the Report of the Boundary Commission upon the Survey and Re-marking of the Boundary between the United States and Mexico West of the Rio Grande, 1891 to 1896 (3 vols., Washington: Government Printing Office, 1898).

Map of the water boundary from the San Juan River to the Gulf of Mexico

(54 sheets; scale 1:10,000)

Maps of a few other sections of the water boundary

Maps of a few individual bancos

This map and the two items that follow it form part of the Proceedings of the International (Water) Boundary Commission, United States and Mexico (Washington: Government Printing Office, 1903).

Map of the Rio Grande Extending from Roma to the Gulf of Mexico

(A topographic map, on the scale of 1:10,000, with an index map on the scale of 1:100,000, showing the boundary between the United States and Mexico, and bancos which have been eliminated under the Treaty of March 20, 1905.)

The map forms part of the Proceedings of the International Boundary Commission, United States and Mexico, American Section: Joint Report of the Consulting Engineers on Field Operations of 1910-1911 (Washington, 1913).

*But see also S. F. Bemis and G. G. Griffin, Guide to the Diplomatic History of the United States, 1755-1921 (Washington Government Printing Office, 1935), p. 553.

STATE DEPARTMENT — Bibliographical Aids

International Boundary . . . .
(Cont.)

B. Maps of Elimination of Bancos:

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| Maps of individual bancos on original scale of 1:10,000 | These maps are contained in:<br>1) Proceedings of the International Boundary Commission, United States and Mexico, American Section. Elimination of 57 old bancos specifically described in the Treaty of 1905, First Series, Nos. 1-58 (Washington: Byron S. Adams, 1910).<br>2) Proceedings of the International Boundary Commission, United States and Mexico, American Section. Elimination of bancos, Treaty of 1905, Second Series, Nos. 59-89 (Washington, 1913). |
| General map of the Colorado River<br>(Scale 1:10,000. Only that part of the river forming the international boundary line is included in the map.) | The following three map items form part of the Proceedings of the International Boundary Commission, United States and Mexico, Elimination of bancos under Convention of March 20, 1905, Colorado River, Nos. 501 and 502, Rio Grande, Nos. 90-131 inclusive (Washington, 1929). |
| General map of the Rio Grande from Roma to the Gulf of Mexico<br>(On the original scale of 1:25,000) | |
| Maps of individual bancos on original scale of 1:5,000 | |
| General map of the Rio Grande in the El Paso-Juarez Valley<br>(Scale, 1:25,000) | These three map items form part of the Proceedings of the International Boundary Commission, United States and Mexico. Elimination of bancos under Convention of March 20th, 1905, El Paso-Juarez Valley, Rio Grande, Nos. 301-319 inclusive, Fourth Series (Washington, D. D., 1931). |
| Maps of individual bancos on original scale 1:5,000 | |
| Map showing river movements near Cordova, and one other map showing river movements near San Lorenzo | |

STATE DEPARTMENT — Bibliographical Aids

International Boundary . . . . (Cont.)

C. Map of Rectification of the Rio Grande:

Map of the Rio Grande in the El Paso-Juarez Valley

(The map shows the procourse of the rectified channel and the areas to be cut from the United States and Mexico.)

The map forms Exhibit No. 2 of the Joint Report of the Consulting Engineers on the Rio Grande Rectification in the El Paso-Juarez Valley. The joint report itself forms an appendix to Treaty Series, No. 864: Rectification of the Rio Grande, Convention between the United States and Mexico, February 1, 1933 (Washington: Government Printing Office, 1934).

The map may be obtained from the Superintendent of Documents, Washington, D. C., for 20¢.

State Department, Office of the Historical Adviser

The following list of maps published by the Department of State up to August 28, 1935, has been kindly compiled by the Office of the Historical Adviser for this map-list.

For a list of the maps see Price List 53. The maps are for sale by the Superintendent of Documents.

The cumulative quarterly list of Publications of the Department of State, which has been published by the Department since Oct. 1, 1929, might also be consulted.

Armenia

Map showing boundary between Turkey and Armenia as determined by Woodrow Wilson . . . .

(Scale 1:1,000,000. Compiled under direction of Major Lawrence Martin by the U. S. Geological Survey and engraved and printed by it in 1920.)

No distribution of this map has as yet been made. A facsimile of the map will accompany U. S. Department of State, Papers Relating to Foreign Relations of the United States--1920, which is now in process of publication.

China

General map of China and adjacent regions, showing treaty ports and railways

(Scale 1:10,000,000. 1921 and 1922 are the first and last issue dates. Prepared for the State Department by the U. S. Geological Survey.)

The map is out of print. It is listed in former issues of Price List 53.

STATE DEPARTMENT — Bibliographical Aids

State Department, Office of the Historical Adviser

China (Cont.)

| | |
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| Map of China and adjacent regions showing railways and principal caravan routes.<br>(Scale 1:10,000,000. December, 1932. Compiled in the Office of the Geographer, Department of State. Has alphabetical index of approximately 800 geographic names.) | The map is listed in various issues of Price List 53 and also in the quarterly list of Publications of the Department of State. |

Florida

| | |
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| Map showing the relation of the Floridas to the Treaty with Spain of 1819 | This map is contained in U. S. Department of State. Treaties and other International Acts of the United States of America, Vol. 3 (1933) p. 41, edited by Hunter Miller. |

Manchuria

| | |
|---|---|
| Map of Manchuria and adjacent regions showing railways and principal motor routes<br>(Scale 1:3,000,000. First published June, 1931; revised January, 1932, February, 1933. Compiled in the Office of the Geographer, Department of State. Reproduced by photolithography by the U. S. Geological Survey. The map has an alphabetical index with approximately 600 geographic names.) | This map is out of print. It is listed in various issues of Price List 53 and in the quarterly list of Publications of the Department of State. |

Mexico

| | |
|---|---|
| Mapa de los Estados Unidos de Mejico, segun lo organizado y definido por las varias actas del Congreso de dicha Republica; y construido por las mejores autoridates. Lo publican J. Disturnell, 102 Broadway, Nueva York, 1847. Revised edition, 1935. | This map is to be reproduced in facsimile in 1935 and is to accompany the printed text of the treaty of February 2, 1848, between the United States and Mexico. This printed text is now in process of publication as Document 129 in Vol. 5 of U. S. Department of State. Treaties and other International Acts . . . . |

STATE DEPARTMENT — Bibliographical Aids

State Department, Office of the Historical Adviser (Cont.)

North America

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|---|---|
| Mitchell's map. The Steuben-Webster copy. Fourth English edition, 1775<br>(Reproduced in facsimile at half the scale of the original map, i.e., 1:4,000,000) | The map has been reproduced in 1933 and issued as a supplement to Treaties and other International Acts of the United States of America, Vol. 3, (1933). |

Oregon Country

| | |
|---|---|
| Map of Oregon country<br>(Scale 1:10,000,000) | The map was compiled in 1935 and is to accompany the printed text of the treaty of June 15, 1846, between the United States and Great Britain. The text is now in process of publication as Document 122 in Vol. 5 of the U. S. Department of State. Treaties and other International Acts . . . . |

Philippine Islands

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|---|---|
| Maps of the Philippine Islands boundary with British North Borneo<br>(Two maps compiled on portions of U. S. C. & G. S. charts as base: Map 1, chart No. 4707; map 2, chart No. 4720. Reproduced at U. S. Government Printing Office.) | In U. S. Department of State. Boundary between the Philippine Archipelago and the State of North Borneo: Convention between the United States of America and Great Britain, and Exchanges of Notes Regarding Certain Islands off the Coast of Borneo. Signed at Washington, January 2, 1930 . . . . Washington, 1933. This is also identified as U. S. Department of State. Treaty Series, No. 856. |

Rio Grande

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| Map of Rio Grande, El Paso-Juarez Valley<br>(Scale 1:112,500. By the International Boundary Commission, United States and Mexico. Map shows located line and tracts cut from United States and from Mexico. Reproduced at the U. S. Government Printing Office, 1934.) | In U. S. Department of State. Rectification of the Rio Grande: Convention between the United States of America and Mexico. Signed at Mexico City, February 1, 1933 . . . . Washington, 1934. Also identified as U. S. Department of State. Treaty Series, No. 864; Exhibit No. 2 (map) folded and inserted following page 48. |

STATE DEPARTMENT — Bibliographical Aids

State Department, Office of the Historical Adviser

Rio Grande (Cont.)

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|---|---|
| Map of Rio Grande drainage basin<br>(Scale 1:5,000,000. United States reclamation service, Rio Grande project, New Mexico. Revised, and drainage area table added, by International Boundary Commission, June, 1930. Reproduced at U. S. Government Printing Office, 1934.) | This map is Exhibit No. 4 and is inserted in the same publication as the preceding map. |

San Diego

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|---|---|
| Plano del puerto de S. Diego en la costa setentl de Califorms. Levantado por el 2º piloto de la Armada D. Juan Pantoja. Ano 1782. | This map is to be reproduced in facsimile, in 1935, to accompany the printed text of the treaty of February 2, 1848, between the United States and Mexico. This text is now in process of publication as Document No. 129 in Vol. 5 of U. S. Department of State. Treaties and other International Acts. . . . |

Texas

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|---|---|
| Historical diagram of Texas<br>(Scale 1:12,500,000) | In U. S. Department of State. Treaties and other International Acts of the United States of America, Vol. 4 (1934), page 143; edited by Hunter Miller. |

United States--Canada

| | |
|---|---|
| Map of boundary from the 49th parallel to the Pacific Ocean; scale 1:2,000,000 | This map compiled in 1935 as a supplement to the printed text of the treaty of June 15, 1846, between the United States and Great Britain. The text is now in process of publication as Document No. 122 in Vol. 5 of U. S. Department of State. Treaties and other International Acts . . . . |

STATE DEPARTMENT — Bibliographical Aids

State Department, Office of the Historical Adviser (Cont.)

World maps

Department of State: Foreign service posts, passport and despatch agencies, as of January 1, 1932

(Equatorial scale 1:40,000,000. Compiled by the Office of the Geographer, Department of State. A revision of this map is under consideration.)

The map forms Publication No. 277 of U. S. Department of State, Map series No. 3. It is listed in Price List 53 and also in the quarterly list of Publications of the Department of State.

The New World and the European colonial system in 1823 . . . . in 1931

(Two maps on one sheet. Published by the Department of State, June, 1931. Printed by the U. S. Geological Survey.)

The map forms Publication No. 275 of U. S. Department of State, Map series No. 1. It is listed in Price List 53 and also in the quarterly list of Publications of the Department of State.

Quota areas (Immigration Act of 1924)

(Equatorial scale 1:100,000,000. Compiled in the Office of the Geographer, Department of State.)

In U. S. Department of State. Admission of Aliens into the United States: Notes to Section 361, Consular Regulations. Revised to July, 1932. Also identified as U. S. Department of State, Publication No. 403. (Map folded opposite page 104.)

WAR DEPARTMENT

Army Air Corps

Strip airway maps

(Scale 1:500,000. About 63 maps have been issued of this series. They cover a strip of territory approximately 80 miles wide.)

Note: See also the airway maps issued by the Coast and Geodetic Survey, Department of Commerce, and the aviation charts published by the Hydrographic Office, Navy Department.

Note: The strip maps of the Army Air Corps are distributed solely by the Coast and Geodetic Survey and are included in its list of publications. These maps are now superseded by the sectional aeronautical charts, on the same scale, also issued by the Coast and Geodetic Survey, which see.

WAR DEPARTMENT — Bibliographical Aids

Corps of Engineeers, U. S. Army

Atlantic Region:

North Atlantic Division

Covers all the waterways of the northern United States draining into the Atlantic Ocean between the eastern point of Maine and the southern line of Delaware.

Division headquarters: Room 601, 39 Whitehall Str., New York, N. Y.

Note: Neither the division office nor any of its districts is a map issuing agency for the purpose of supplying maps to the public. However, copies of the tracings and blueprints prepared in connection with improvements in rivers and harbors are available to interested persons, at cost, by application to the proper district office.

District Offices and their map publications:

Eastport, Me., District

Covers the St. Croix River, Cobscook Bay, Machias River, and tributaries thereof.

Address: The address of this district is temporarily c/o The Chief of Engineers, U. S. Army, Washington, D. C. Inquire at this office for map publications.

Note: For maps and charts showing port and harbor facilities of Portland, Me., see Port Series No. 1 (revised, 1927).

This port series report is prepared by the Board of Engineers for Rivers and Harbors, War Department, Washington, D. C. It is obtainable from the Superintendent of Documents.

Boston, Mass., District

Covers the area from below Machias River down to Cape Cod, including the Cape Cod Canal.

Address: 13th Floor, Customhouse, Boston, Mass. Inquire at this office for available map publications.

Note: For maps and charts showing port and harbor facilities, see Port Series No. 2: Boston, Mass. (revised 1929).

Obtainable from the Superintendent of Documents, Washington, D. C.

Providence, R. I., District

Covers the area from below Cod Canal to the New York-Connecticut line.

Address: 419 New Federal Building, Providence, R. I. Apply to this office for available map publications.

First New York District

Covers area from Long Island to Hudson River and New York Harbor

Address: Room 710, 39 Whitehall Str., New York, N. Y. Apply to this office for available map publications.

WAR DEPARTMENT — Bibliographical Notes

Corps of Engineers, U. S. Army

North Atlantic Division

District Offices and their map publications: (Cont.)

| | |
|---|---|
| Second New York District<br>Covers the area from New Jersey to Asbury Park. | Address: Room 616, 39 Whitehall Str., New York, N. Y. Apply to this office for available map publications. |
| Note: A series of navigation charts for the New York State canals has been made available by the State of New York. | For a list of these charts as well as the charts themselves, apply to the Division of Canals and Waterways, Department of Public Works, Albany, New York. |
| Note: For maps and charts showing the port and harbor facilities at New York, see Port Series No. 20: New York (in three parts, complete, revised in 1932). | This report is obtainable from the Superintendent of Documents. |
| Philadelphia, Pa., District<br>Covers the area from Asbury Park to the southern line of Delaware. | Address: Customhouse, Second and Chestnut Streets, Philadelphia, Pa |
| Note: For maps and charts showing port and harbor facilities, see Port Series No. 4: Philadelphia and Chester, Pa., Camden, N. J., and Wilmington, Del., Parts 1-2 (revised 1931). | The two parts of this report may be purchased separately from the Superintendent of Documents. |
| Puerto Rico District<br>Covers the island of Puerto Rico and adjacent United States islands. | Address: Room 616, 39 Whitehall Str., New York, N. Y. |
| Note: For maps and charts showing port and harbor facilities, see Port Series No. 21: Ports of Puerto Rico. | Obtainable from the Superintendent of Documents. |

WAR DEPARTMENT — Bibliographical Aids

Corps of Engineers, U. S. Army

Atlantic Region:

South Atlantic Division

Division headquarters: 415 Federal Building, Norfolk, Va.

Note: The division office is not itself a map issuing agency. Application for the map publications of the division should be addressed to the individual district offices.

District Offices and their map publications:

Baltimore, Md., District

No charts or maps are issued for public use.

Address: 332 Post Office Building, Baltimore, Md.

Note: For maps and charts showing ports and harbor facilities, see Port Series No. 16: Baltimore, Md., Washington, D. C., and Alexandria, Va.

Obtainable from the Superintendent of Documents.

Charleston, S. C., District

Only project maps stressing hydrographic detail are issued.

Address: P. O. Box 905, Charleston, N. C.

Note: For maps and charts of port and harbor facilities, see Port Series No. 9: Charleston, S. C., and Wilmington, N. C.

Obtainable from the Superintendent of Documents.

Jacksonville, Fla., District

Covers, with certain exceptions, the harbors and waterways of Florida east of and including the Aucilla River.

Address: 4 East Bay Str., Jacksonville, Fla.

Maps are available for all the projects and waterways within the jurisdiction of the district. They may be had at the cost of printing.

Maps of:

Intracoastal Waterway and other Projects in the Jacksonville, Fla., District. (May, 1935. Black line print; scale 10 miles to one inch; size approx. 3 x 7 feet. Map shows and tabulates all the projects in the district.)

No map list is published; but a printed booklet, entitled Index Maps, containing some twenty-one index and project maps of the river and harbor is available on application.

WAR DEPARTMENT

Bibliographical Aids

Corps of Engineers, U. S. Army

South Atlantic Division

See note on preceding page.

District Offices and their map publications:

Jacksonville, Fla., District

Maps of: (Cont.)

St. John River, Fla.
(April, 1935. Blue line print; scale 1:25,000. Nomenclature of cuts and lighted ranges are shown.)

Note: For charts and maps showing port and harbor facilities, see Port Series No. 8: Jacksonville, Miami, Key West, Tampa, and South Boca Grande, Fla. (Part I, revised in 1929; Part II, in 1930).

This port series report is for sale by the Superintendent of Documents, Washington, D. C.

Savannah, Ga., District

Address: Post Office Building, Savannah, Georgia.

Maps of:

Altamaha River: mouth to Forks (1910; 14 sheets)

Brunswick Harbor: Atlantic Ocean to head of harbor (1934; 11 sheets)

Fernandina Harbor: Atlantic Ocean to head of harbor (1934; 6 sheets)

Intracoastal Waterway: Beaufort, S. C., to Fernandina, Fla. (Recent date; number of map sheets varies.)

Ocmulgee River: mouth at Forks to Macon, Ga. (1910; 13 sheets)

Oconee River: mouth at Forks to Milledgeville, Ga. (1910; 12 sheets)

St. Marys River: mouth to A. C. L. Railroad Bridge (1909; 7 sheets)

Blue- or blue-line prints of these maps are available to responsible persons at the cost of reproduction amounting to approximately 25¢ the sheet. No separate map list is issued.

WAR DEPARTMENT

Corps of Engineers, U. S. Army

South Atlantic Division

District Offices and their map publications:

Savannah, Ga., District

Maps of: (Cont.)

Satilla River; mouth to Burnt Fort, Ga. (1909-10; 9 sheets)

Savannah Harbor: Atlantic Ocean to head of harbor (1935; 12 sheets)

Savannah River: Savannah, Ga., to Augusta, Ga. (1914; 26 sheets)

(The maps vary in scale from 1:2,000 to 1:10,000; they are in the form of tracings or sepia prints.)

Note: For maps and charts of port and harbor facilities, see Port Series No. 10: Savannah and Brunswick, Ga.

Note: A comparatively narrow strip along the entire Atlantic Coast within the Savannah district is covered by the so-called "Tactical Maps" prepared by the Corps of Engineers. These maps are similar in form to the quadrangle maps of the U. S. Geological Survey and are, as a rule, not duplicated by the latter. The following maps of this series are available, to date:

Hardeeville
788-S-I-E/2 Ga.S.C.
Meldrim
788-S-IV-W/2 Ga.
Savannah
788-S-IV-E/2 Ga.S.C.

Bibliographical Aids

See note on preceding page.

This port series report is for sale by the Superintendent of Documents, Washington, D. C.

An Alphabetical List of Corps of Engineers Maps (43 pp.) was issued October 1, 1937 by the Engineers Reproduction Plant, Fort Humphreys, D. C. It lists over a thousand topograpic maps on scales of 1:48,000, 1:62,500, 1:125,000, and 1:250,000, with indication of latitude, longitude, colors and index number. The list does not include the terrain and special military maps published on scales other than 1:62,500 or 1:125,000, nor the Mississippi River Commission's quadrangle maps.

These maps are obtainable from the Office of the Chief of Engineers, War Department, Washington, D. C., at a cost of 10¢ the sheet.

WAR DEPARTMENT

Corps of Engineers, U. S. Army

South Atlantic Division

District Offices and their map publications:

Savannah, Ga., District

Maps of: (Cont.)

Ossabaw Island
789-N-II-E/2 Ga.
Limerick
789-N-II-W/2 Ga.
Ludowici
789-N-III-W/2 Ga.
St. Catherine Island
789-N-IV-E/2 Ga.
Sapelo River
789-N-IV-W/2 Ga.
Cabretta Island
789-S-II-E/2 Ga.
Darien
789-S-II-W/2 Ga.
Brunswick
789-S-IV-W/2 Ga.
Fort Fremont
807-S-I-E/2 S.C.
Okatie
807-S-I-W/2 S.C.
St. Helena Sound
807-S-II-W/2 S.C.
Nilton Head
807-S-III-E/2 S.C.
Blafton
807-S-III-W/2 S.C.
Ossabaw
807[a]-N-I-W/2 Ga.

Washington, D. C., District

Covers all tributaries and their watersheds which empty into the west side of Chesapeake Bay between Cove Point, Md., and York Point, Va.

Bibliographical Aids

See note on preceding page.

See also the Alphabetical List of Corps of Engineers Maps described on the preceding page.

Address: Room 1068, Navy Building, Washington, D. C.

Copies of the maps on file in this district office are available at nominal cost. No map list is issued.

A set of small key or reference maps, in blueprint form, covering each of the projects in the district, may be obtained from the office.

WAR DEPARTMENT

Corps of Engineers, U. S. Army

South Atlantic Division:

District Offices and their map publications:

Washington, D. C., District (Cont.)

Note: For maps and charts of the port and harbor facilities, see Port Series No. 16: Baltimore, Md., Washington, D. C., and Alexandria, Va.

Great Lakes Division:

U. S. Lake Survey Office:

Charts of the Great Lakes, Lake Champlain, New York Canals, and Lake of the Woods.

(These charts are primarily for navigational use. They depict the hydrography of the water areas along the shores. Revised editions of the charts are issued about every three years.)

Note: A Lake Series of reports, similar to the Port Series, has been issued for the principal ports of the Great Lakes since 1931. The following reports of the series have been issued to date:

No. 1. The Port of Buffalo, N. Y. (1931)
No. 2. The Port of Detroit, Mich. (1931)
No. 3. The Port of Milwaukee, Wisc. (1931)
No. 4. The Port of Chicago, Ill. (1932)
No. 5. The Port of Cleveland, Ohio (1932)
No. 6. The Port of Duluth-Superior, Minn. and Wisc. (1932)
No. 7. The Port of Toledo, Ohio (1932)
No. 8. The Ports of Sandusky, Huron, and Lorain, Ohio (1932)

Bibliographical Aids

See note on preceding page.

This port series report is obtainable from the Superintendent of Documents, Washington, D. C.

Address: 649 Federal Building, Detroit, Michigan.

A comprehensive and detailed Catalogue of Charts of the Great Lakes, Lake Champlain, New York Canals, Lake of the Woods is issued and distributed by the Lake Survey Office. Key index maps covering all the charts issued by the office are included in the catalog. The current edition is dated 1935.

The Survey Office also issues, and revises annually, Bulletin No. 43, which contains information supplementary to that shown on the charts. Monthly supplements to this bulletin are published during the navigation season.

The Lake Series reports are prepared by the Board of Engineers for Rivers and Harbors, War Department, Washington, D. C., and are for sale by the Superintendent of Documents.

WAR DEPARTMENT — Bibliographical Aids

Corps of Engineers, U. S. Army (Cont.)

Gulf of Mexico Division: — Division headquarters: 412 Masonic Temple, New Orleans, La.

Note: No maps or charts are distributed by the division office. Apply to the district offices for available map publications.

District Offices and their map publications:

Galveston, Tex., District

Includes all river and harbor improvements in Texas except in the Red River Basin, and Johnsons Bayou, La. — Address: Trust Company Building, Galveston, Texas.

No map list is available.

Note: For maps and charts of port and harbor facilities, see Port Series No. 6: Galveston, Houston, and Texas City, Texas; Parts 1-2 (revised 1928) — The port series report is for sale by the Superintendent of Documents, Washington, D. C.

Mobile, Ala., District

Includes the harbors on the coasts of Mississippi and Alabama and in the northwestern portion of Florida; also all rivers flowing into the Gulf of Mexico west of and including the Pearl River, La. and Miss. — Address: 306 Staples-Powell Building, Mobile, Ala. No map list is issued.

Note: For maps and charts of port and harbor facilities, see Port Series No. 3: Mobile, Ala., and Pensacola, Fla. Parts 1-2 (revised 1929). — This port series report in two parts may be purchased from the Superintendent of Documents.

New Orleans, La., District

Includes the Passes of the Mississippi and the river between New Orleans and Baton Rouge, La.; also the portion of the Intracoastal Waterway extending from the Inner Harbor Navigation Canal in Lake Pontchartrain to Long Point Light, in Lake Borgne. — Address: 604 Union Building, New Orleans, La.

No map list is available.

WAR DEPARTMENT — Bibliographical Aids

Corps of Engineers, U. S. Army

Gulf of Mexico Division:

New Orleans, La., District(Cont.)

Map of the Intracoastal Waterway through Louisiana and Texas

(This map shows also the Industrial Canal in New Orleans.)

The map is issued in two sizes: 36 x 60 inches and 18 x 31 inches. Apply to the district office.

Note: Detailed maps of the Industrial Canal, Inner Harbor Navigation Canal, New Orleans, are contained in the pamphlet Port Handbook of New Orleans.

This handbook is published by the Board of Commissioners of the Port of New Orleans (A state agency) and is obtainable free. The Board is located at 200 N. O. Court Building, New Orleans.

Note: For maps and charts of port and harbor facilities, see Port Series No. 5; New Orleans; (revised 1931).

This port series report is for sale by the Superintendent of Documents, Washington, D. C.

Mississippi Valley Divisions:

Lower Mississippi Valley Division:

Address: P. O. Box 665, Vicksburg, Miss.

Mississippi River Commission

The Commission's jurisdiction extends over navigation improvement on the Mississippi River between Cairo, Ill., and Baton Rouge, La., and over flood control works on the main river, its tributaries, and outlets.

Note: The office of the President of the Mississippi River Commission and that of the Division Engineer operate as a single organization. This organization is by far the most important mapping agency in the Mississippi Valley.

A few of the numerous map publications of the Commission are as follows:

The Commission's map publications are detailed in the following descriptive lists:

Map of the Alluvial Valley, Lower Mississippi, from Cape Girardeau, Mo., to the Gulf of Mexico. (Prel. edit., 1930)

(2 sheets; scale 1:500,000; 5-foot contours. The map is available with or without the flood control project of the Army engineers. Topographic details are shown. Use is made of colors.)

1) Descriptive Price-list of maps published by the Mississippi River Commission. This is a printed list of four pages, listing 11 sets of maps. A mimeographed sheet, released July, 1934, describes a twelfth set of maps, dated March-June, 1934.

WAR DEPARTMENT — Bibliographical Aids

Corps of Engineers, U. S. Army

Lower Mississippi Valley Division:

Mississippi River Commission (Cont.)

Map of the entire Mississippi River Basin from Cape Girardeau, Mo., to the Gulf of Mexico (compiled from recent surveys)

(5 sheets; scale 1:250,000. The map covers approximately 100 miles east and west of the Mississippi River.)

Charts of the Mississippi River from the mouth of the Ohio River to the Head of Passes, La. (from re-surveys, 1911-14, 1921-25)

(89 sheets; 2 index maps; scale 1:20,000. Topography within a mile or so of the river bank and 5-foot contours are shown.)

Map of the Mississippi River from Cairo, Ill., to the Gulf of Mexico, La. (from surveys of 1919-33 and latest information).

(60 sheets, including 4 index maps; scale 1:62,500; 5-foot contours. The maps are black-line photo-offset productions; they are for general navigational use and show location of channel line and navigation lights as of Mar.-Je., 1935.)

Topographic quadrangle maps of the Alluvial Valley of the Lower Mississippi River. (survey 1929-33; preliminary sheets; some final sheets are now available).

(177 sheets; scale 1:62,500; 5-foot contours. These quadrangle maps form part of the standard topographic mapping of the United States.)

2) Location Sheets "A", "B", "C", "D", "E", are supplementary to the above price-list. These are printed leaflets which designate the precise location of the map sheets which make up the sets of maps described in the price-list.

The Commission also issues a circular (6 large pages, mimeographed) containing "General Information Concerning Navigation on the Mississippi River and its Tributaries, Available Maps and Charts, and Bibliography of Publications Containing Detailed Data."

All the maps, charts, and map lists prepared by the Commission are obtainable from the President of the Mississippi River Commission, P. O. Box 665, Vicksburg, Miss.

This set of maps is available only in the complete form of 60 sheets.

An index map entitled Index of Quadrangles, Alluvial Valley of the Mississippi River is available from the Commission for this set of quadrangle maps.

Note: Thirty-two additional quadrangle maps on the scale of 1:48,000 have been contributed to this series by the U. S. Geological Survey. These maps are likewise shown and identified on the above index map.

WAR DEPARTMENT — Bibliographical Aids

Corps of Engineers, U. S. Army

Lower Mississippi Valley Division: (Cont.)
District Offices and their map publications:

Memphis, Tenn., District

Map of the Arkansas River (compiled from recent surveys)

(40 sheets; sheets 1-10 are on the scale of 1:48,000 and sheets 11-40 are on the scale of 1:25,000. The maps are available in blue-line prints; they show the course of the river and the main topographic features.)

Address: P. O. Box 97, Memphis, Tennessee.

Apply to the district office for this map and also for the maps of the St. Francis and White Rivers. No special map list is issued.

Vicksburg, Miss., District

Maps of the Ouachita, Red, Yazoo Rivers and tributaries

(Only blueprint copies of these maps are available, except the quadrangle maps which are printed.)

Address: P. O. Box 667, Vicksburg, Miss.

A detailed, mimeographed price-list is issued for these maps by the district office.

Mississippi Valley Divisions:

Upper Mississippi Valley Division:
Includes the Mississippi River system and tributaries above the Ohio River but exclusive of the Missouri River system above Hermann, Mo., this latter section being under the jurisdiction of the Missouri River Division.

Division headquarters: 815 Victoria Building, St. Louis, Missouri.

Note: A select list of the maps and charts prepared by the various district offices in the division has recently been issued by the division office as Division Bulletin No. 1 (May, 1935).

This bulletin is a descriptive price-list of maps and charts suited for navigation of the Mississippi River between the Gulf of Mexico and Minneapolis, Minn., and the Illinois Waterway. It is to be revised from time to time and is obtainable from the division office at the above address.

WAR DEPARTMENT

Corps of Engineers, U. S. Army

Bibliographical Aids

Upper Mississippi Valley Division: (Cont.)

See note on preceding page.

District Offices and their jurisdiction:

St. Paul, Minn., District
Covers the Mississippi River and tributaries above and including Wisconsin River.

Address: 615 Commerce Building, St. Paul, Minn. See the above Division Bulletin No. 1 for this district's map publications.

Rock Island, Ill., District
Covers the Mississippi River and tributaries between Wisconsin River and Clarksville, Mo.

Address: Clock Tower Building, Rock Island, Ill. See the above Division Bulletin No. 1 for this district's map publications.

St. Louis, Mo., District
Covers the Mississippi River and tributaries between Clarksville, Mo., and the Ohio River; also the Missouri River between Hermann, Mo., and the mouth.

Address: 428 Customhouse, St. Louis, Mo. See the above Division Bulletin No. 1 for the map publications of this district.

Chicago, Ill., District
Covers the Illinois River and tributaries together with certain canals and waterways in the vicinity of Chicago.

Address: 932 Post Office Building, Chicago, Ill.

The following charts are issued:

Navigation charts of the Illinois Waterway System, Lake Michigan, at Chicago, to the Mississippi River, at Grafton,--about 38 mi. above St. Louis.

(The charts are in sections of 8, 22, and 48 sheets, respectively; scale 1 inch to 800 ft.)

A special price-list "Bulletin No. 2" is issued by the district to describe its chart publications. It is obtainable free from the district office. However, the district's charts are also listed in the above-mentioned Division Bulletin No. 1.

WAR DEPARTMENT — Bibliographical Aids

Corps of Engineers, U. S. Army (Cont.)

Missouri River Division:

The Missouri River and tributaries, from Hermann, Mo., to Yellowstone River and beyond, are included in this division.

Division headquarters: 707 Postal Telegraph Building, Kansas City, Missouri.

Map sets are available of the Missouri River and tributaries, the Gasconade River, Osage River, Big Blue River, Kansas River, and Yellowstone River; maps of the Fort Peck Reservoir and of the harbor lines are also available.

A detailed, descriptive price-list (4 mimeographed pages) of the "Maps Available for Distribution" lists conveniently all the maps of the division. This list, as well as the maps and charts contained therein, is obtainable from the division office at Kansas City, Mo. Copies of the maps are furnished at cost in the form of blue prints or blue-line prints.

District Offices and their jurisdiction:

Kansas City, Mo., District

Covers the Missouri River from Hermann, Mo. (about 97 miles above the mouth) to the mouth of Nodaway River.

Address: 232 Manufacturers Exchange Building, Kansas City, Mo. See the above noted division list for maps of this district.

Omaha, Nebr., District

Covers the Missouri watershed from the mouth of the Nodaway River to the mouth of the Yellowstone River.

Address: 819 City National Bank Building, Omaha, Nebr. See the division list for the maps of this district.

Fort Peck, Mont., District

Covers the Missouri River above Yellowstone River.

Address: Administration Building, Fort Peck, Mont.

Note: The section of the Missouri River from its mouth to Hermann, Mo., is under the jurisdiction of the St. Louis District, Upper Mississippi Valley Division.

WAR DEPARTMENT

Bibliographical Aids

Corps of Engineers, U. S. Army (Cont.)

Ohio River Division:

Division headquarters: 413 Customhouse, Cincinnati, Ohio.

Charts and maps of the Ohio River and of some 57 tributary streams and waterways are available in this division.

(See the division's comprehensive list for precise data on the scope and nature of these charts and maps.)

An excellent and practically exhaustive list of the map and chart publications prepared by the district offices within the division has recently been compiled and published by the division office, with the title Tabulation of Charts and Maps in Ohio River Division (May, 1935).

The list extends over some twenty sheets and tabulates for each map and chart the following precise data:

name of river; extent of chart to nearest town, with mileage; scale and size of chart; type of print; date of survey; presence of contours and soundings; datum of elevation; cost of chart, and name of district from which obtainable; and, finally, some qualifying remarks.

The list is obtainable from the division office at Cincinnati, but the charts must be purchased from the respective district offices.

District Offices and their jurisdiction:

Cincinnati, Ohio, District
Comprises the stretch of the Ohio River from about mile 317.5 below Pittsburgh just below the mouth of Big Sandy River, Ky., to about mile 556.2 just above Madison, Ind.

Address: 408 Customhouse, Cincinnati, Ohio. See the division list mentioned above for the maps of this district.

Huntington, W. Va., District
Includes the Ohio River, W. Va., with its locks and dams, also Little Kanawha River, W. Va., Kanawha River, W. Va., Big Sandy River, W. Va., and Ky., with Tug and Levisa Forks.

Address: P. O. Box 548, Huntington, W. Va. For the maps of this district, see the above-mentioned division list.

WAR DEPARTMENT — Bibliographical Aids

Corps of Engineers, U. S. Army

Ohio River Division:

District Offices and their jurisdiction: (Cont.)

Louisville, Ky., District
Comprises the portion of the Ohio River lying between Madison, Ind., and Mound City Ill.; also the watersheds in Indiana and Illinois draining into this portion of the Ohio River, and part of Kentucky lying between the watersheds of the Kentucky and Cumberland Rivers.

Address: 431 Customhouse, Louisville, Ky. For maps of this district, see the division list mentioned on page 215.

A special, mimeographed map list is available from this district office. But, with the exception of the maps of the Eel River, the contents of the list are duplicated in the above-noted division list.

Nashville, Tenn., District
Includes the entire drainage basins of the Cumberland and Tennessee Rivers.

Address: 322 Customhouse, Nashville, Tenn. For the map publications of this district, see the division map list mentioned on page 215.

Pittsburg, Pa., District
Includes the watershed of the Ohio River between Captina Island and Powhatan Point,--a distance of 109 miles.

Address: 925 New Federal Building, Pittsburgh, Pa. For the map publications of this district, see the division list noted on page 215.

Zanesville, Ohio, District
Embraces all of the Muskingum River watershed.

Address: First National Bank Building, Zanesville, Ohio. For the map publications of this district, see the division list mentioned on page 215.

Pacific Region:

North Pacific Division:
Covers the drainage areas of the Columbia Rivers and of the streams draining into the Pacific on the Oregon, Washington, and Alaskan coasts.

Division headquarters: 523 Pittock Building, Portland, Oreg.

Note: Maps for regular distribution are not issued by either the division office or its districts. However, copies of all maps on file are available to interested persons by application to the respective district offices.

WAR DEPARTMENT — Bibliographical Aids

Corps of Engineers, U. S. Army

North Pacific Division: (Cont.)

District Offices and their map publications:

Portland, Oregon, District

Includes the Snake and Columbia River basins between the mouth of the Snake River and Vancouver, Wash.; also tributaries of Columbia River below the Snake River, and the Snake River Basin in Washington, Idaho, Wyoming, Utah, and Nevada.

Address: 306 Customhouse, Portland, Oregon. Apply to this district office for information about its map publications.

Note: For maps and charts of port and harbor facilities, see Port Series No. 11; Portland and Astoria, Oreg., and Vancouver, Washington; Parts 1-2, (revised 1931)

This port series report is for sale by the Superintendent of Documents, Washington, D. C.

Seattle, Wash., District

Includes the states of Washington and Idaho except the basins of the Snake and Columbia Rivers below the mouth of the Snake; also that part of Montana west of the Rocky Mountains, and also Alaska.

Address: 412 Federal Office Building, Seattle, Washington. Apply to this district office for information about its map publications.

Note: For maps and charts of port and harbor facilities, see Port Series No. 7: Seattle, Tacoma, Everett, Bellingham, and Grays Harbor, Wash.; Parts 1-3 (revised 1931)

Pacific Region:

South Pacific Division:

Division headquarters: 414 Customhouse, San Francisco, Calif.

Note: The division office does not itself distribute maps, but inquiry regarding such publications may be made of the district offices.

WAR DEPARTMENT — Bibliographical Aids

Corps of Engineers, U. S. Army

South Pacific Division: (Cont.)

District Offices and their map publications:

San Francisco, Calif., District
Comprises all the waterways and tributaries along the Pacific Coast from Cape Martin, Calif., in the south, to the Oregon State line in the north, except the waters of Suisun Bay and the Sacramento and San Joaquin Rivers and tributaries.

Address: 401 Customhouse, San Francisco, Calif.

Note: For maps and charts of the port and harbor facilities, see Port Series No. 12: San Francisco, Oakland, Berkley, Richmond, Upper San Francisco Bay, Santa Cruz, and Monterey, Calif.; Parts 1-2, (revised 1933).

This port series report is for sale by the Superintendent of Documents, Washington, D. C. Each part may be purchased separately.

Los Angeles, Calif., District
Covers the part of California lying south of Cape San Martin, and south of the St. Joaquin Valley drainage basin, together with the drainage basin of the Colorado River and its tributaries.

Address: 751 South Figuerosa Str., Los Angeles, Calif.

Note: For maps and charts of port and harbor facilities, see Port Series No. 13: Los Angeles, Long Beach, San Diego, and San Luis Obispo, Calif.; Parts 1-2 (revised 1930).

This port series report is for sale by the Superintendent of Documents, Washington, D. C. The parts may be purchased separately.

Sacramento, Calif., District
Embraces Suisun Bay, the Sacramento and San Joaquin Rivers and tributaries, and the parts of southern Oregon and of northwestern Nevada that drain toward Central Nevada.

Address: 208 Post Office Building, Sacramento, Calif.

WAR DEPARTMENT

Bibliographical Aids

Corps of Engineers, U. S. Army

South Pacific Division:

District Offices and their map publications: (Cont.)

Honolulu, Hawaii, District
Includes all the islands of the Hawaiian group.

Address: 214 Federal Building, Honolulu, Hawaii.

Note: For maps and charts of port and harbor facilities, see Port Series No. 17: Ports of the Territory of Hawaii.

This port series report is for sale by the Superintendent of Documents, Washington, D. C.

Note: Maps and charts relating to navigation, water power, flood control and irrigation form part of the survey "Reports" on the following individual rivers:

The Sacramento, San Joaquin, the Kern Rivers, the Mad River, and the Klamath River.

Military Intelligence Division

Note: This division is not a map making agency. It does, however, in a few instances, compile maps of foreign countries of which no accurate maps are obtainable. All such maps are placed with the Superintendent of Documents, Washington, D. C., for sale to the public, and may be found listed in Price List 53, which also is obtainable from the Superintendent of Documents.

Geographic Section: General Staff

Map of the Atlantic Ocean (1922)

(Scale 1:23,443,000. The map shows the bordering continents, cable lines and principal steamship routes.)

Map of Central America (1929-35)

(This map, in 34 sheets, covering the area from the Mexican border to Panama, was completed in December., 1935.)

An index chart for the map is available on the scale of 1:250,000. A list of the titles of the individual map (quadrangle) sheets is printed in Price List 53 (June, 1936). Map and index chart are obtainable from the Superintendent of Documents.

Map of Cuba (1934)

(2 sheets; scale 1:500,000)

Mexico. Communication map, with inset of Mexico City and vicinity (1922)

(Scale 1:2,500,000; size 33.7 x 49)

Maps of the United States
(List of Addenda)

Coast and Geodetic Survey (Department of Commerce)

Outline base map 1:5,000,000

(Size 26 x 40 in. Lambert conformal conic projection)

Outline base map 1:7,500,000

(Size 21 x 26 in. Lambert zenithal equal area projection.)

Outline base map 1:5,094,000

(Size 27 x 41 in. Gnomonic projection. In black and white.)

Corps of Engineers, U.S. Army

Official Railroad Map of the United States 1:2,500,000

(Oct., 1935. In 4 sheets; revised from time to time. Compiled under the direction of the Chief of Engineers, U.S. Army. Printed at the Engineers Reproduction Plant, Fort Humphreys, D.C.)

Federal Board of Surveys and Maps

Aerial Photography in the United States, Status of (Map)

(Scale 1:5,000,000. The map shows the status of aerial surveys previous to March, 1937. It does not indicate by what or for what government agency the surveys were made.)

Topographic Mapping in the United States, Status of (Map)

(Dec., 1936. Scale 1:5,000,000. The map shows areas for which topographic sheets have been published or are now being surveyed. Planimetric mapping is also shown. Color tints differentiate areas mapped adequately or inadequately.)

Geological Survey (Department of the Interior)

Base maps of the United States

(Available on the following scales:
40 miles to 1 inch;
110 miles to 1 inch;
190 miles to 1 inch;
260 miles to 1 inch. The first two of these are without contours.)

Coal fields of the United States (Map)

(1917. Scale 37 mi. to 1 in.; size 55 x 85 in. Without contour lines.)

Coal producing districts of the United States (Map)

(1922. Scale 40 mi. to 1 in.; size 49 x 76 in. Without contour lines.)

Oil and gas fields, pipe lines, refining centers, etc. (Map)

(Scale 40 mi. to 1 in.; size 49 x 78 in.)

Physical map of the United States

(Scale 50 mi. to 1 in.; size 40 x 62 in. Brown and blue color shadings show the relative height of the land and the depth of the sea. Positions of the principal cities, and the boundaries of states are also indicated.)

Physiographic map of the United States

(Scale 110 mi. to 1 in.; size 28 x 31 in. Without contour lines.)

Relief or hypsometric map of the United States

(Scale 110 mi. to 1 in.; size 18 x 28 in. Altitudes are indicated by color shadings.)

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# CHAPTER XII

# OFFICIAL MAP PUBLICATIONS OF CANADA

The Topographical and Air Survey Bureau of the Department of the Interior, the Geographical Section of the Department of National Defence, and the Geological Survey of the Department of Mines--all of the Dominion government, at Ottawa--are the most extensive issuing and distributing agencies for maps in Canada. However, practically all of the ten provinces of the Dominion issue maps individually, though the nature and scope of these mapping activities differ considerably from one province to another, as will be indicated further on.

## The Topographical and Air Survey Bureau of the Dominion Government

By far the most prolific of these official mapping agencies is the Topographical and Air Survey Bureau of the Dominion government. Its primary function is the surveying and mapping of the Dominion, the results of which are constantly recorded in the form of maps, plans, and reports. A special catalog,[1] a new edition of which is issued by the Survey about every four years, lists these publications in detail. It may be noted in this connection that the annual report of the Surveyor-General in charge of the Survey Bureau, contains an itemized list of the maps issued by his Bureau during the reported year. The Bureau is, moreover, the sole distributing agent for the map series prepared by the Geographical Section of the General Staff of the Department of National Defence--their maps being included in the Bureau's catalog. In what follows, an attempt has been made to describe or indicate briefly the map productions and also the map lists that have been or are being issued by the mapping agencies of (1) the Dominion government at Ottawa; and of (2) the provincial governments.

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[1]Canada. Topographical and Air Survey Bureau. Catalogue of Maps, Plans and Publications Distributed by the Topographical and Air Survey Bureau (6th ed.; Ottawa, 1934).

## I. Map Publications of the Dominion Government

### MAPS OF THE TOPOGRAPHICAL AND AIR SURVEY BUREAU, OTTAWA[2]

#### National Topographical Series

This series is designed to cover the whole of Canada. The unit area measures 8° of longitude by 4° of latitude and is divided in a regular manner for map sheets on different scales. These sheets are individually identified by a geographic name and an index number and are uniformly 24 x 30 inches in size. The scales on which these maps are now issued are four in number, viz., one, two, four, and eight miles to the inch, respectively. Key-index maps are available for all the maps of the series, and a detailed list of them is included in the catalog.

#### Sectional Maps of Western Canada

These maps cover most of Manitoba, Saskatchewan, Alberta, and the Peace River Block and Railway Belt of British Columbia. They are issued on two scales, namely, three miles to the inch, and six miles to the inch--the latter scale being a reduction of the former. Each map covers an area of about one hundred miles east and west, by fifty miles north and south, and includes 112 townships. The maps of each scale have been issued in three series, viz., a new, an intermediate, and an old series.

The new-series maps are in eight colors; they cover the more highly developed districts and show considerable topographic detail. The intermediate series is in five colors and is issued for areas for which topographical data are incomplete. The old-series maps are issued in from one to four colors; they show townships, sections, and quarter-sections, and the general topography of the country. These sectional maps are not individually listed in the catalog, but key-index charts showing the maps already issued or in preparation are available from the Bureau.

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[2]On the current map publications consult the Bureau's Catalogue of maps . . . . and also the Annual Report of the Topographical and Air Survey Bureau, issued each year for the fiscal ending March 31. It includes an "Index map" to the sheets of the national topographic maps series on the scale of one, two, and four miles to the inch, and also lists of the map sheets and plans issued during the reported fiscal year. The report is obtainable from the Surveyor-General in charge of the Survey Bureau.

## Land Classification Maps, Soil Maps, and Township Development Plans, Western Canada

The land and soil maps were issued for the benefit of intending settlers. The types of land represented on the maps are classified ninefold, ranging from arable land with good soil to land unsuitable for agriculture. The soil maps outline the main soil types, and also the nature of the soil surface. Both the land and the soil maps show the main topographic features, but the maps have been discontinued since 1928. They are listed, however, in the catalog, and a key-index chart for them may be obtained from the Survey Bureau on request. It may also be noted that the first index map showing the location of all the land classification and soil maps published by the Dominion and provincial authorities for the Canadian Northwest, has been included in W. A. Mackintosh's Prairie Settlement: The Geographical Setting, which was published at Toronto in 1934 as Volume I of the larger work, entitled Canadian Frontiers of Settlement.

Township development plans of certain districts covered by the land classification and soil surveys have been issued. These plans are on a scale of three-fourth miles to the inch, and show in colors the nature of the surface of each quarter section of land, and also the main topographic features. The few maps of the series issued are listed in the catalog.

## Various Boundary Map Series

The maps of these series are usually issued in atlas form. They are thus listed in the catalog. But see especially the map catalog--described in another section--of the Geographic Board of Canada, where a separate list of international boundary maps is included.

## Maps of Canadian National Parks and Forest Reserves

A list of these is included in the Bureau's catalog. A separate list of the maps of the Dominion forest reserves, issued between 1915 and 1923, is included in the Catalogue of Maps of Canada, published between January 1, 1922, and December 31, 1924, published by the Geographic Board of Canada in 1925.

### Map Series of the Waterways of the Mackenzie River Basin

The maps of this series have been issued on a scale of four miles to the inch when required for navigation purposes, and on the scale of six miles to the inch when intended for more general use. The maps are listed in the catalog.

### Mosaic Maps

These maps are assemblies of vertical or oblique aerial photographs, in mosaic form. They show a wealth of topographic detail, and photographic copies of them on bromide paper are available. They are listed in the catalog.

### Relief Maps

A certain number of such maps have been prepared for areas of special interest. They may be found listed in the fifth (1930) edition of the catalog, but for the present have been discontinued.

### Canadian Map-sheets of the International Map of the World

Only two sheets of this map have thus far (1935) been published by the Dominion government as its share of the international map. They are the Regina (Saskatchewan) and the Montreal (Ontario and Quebec) sheets.

### Air Navigation and Aerial Strip Maps

Air navigation maps have been issued on scales of four and eight miles to the inch. The aerial strip maps originated with the Geographic Section of the General Staff and are on the scale of four miles to the inch. All these maps are listed in the catalog.

### Magnetic Maps

These maps are especially intended for those making use of the compass as a direction finder. They are listed in the catalog.

### Miscellaneous Maps

Under this head are listed in the catalog, geographic, resource, physical, and climatic maps of Canada as a whole; maps of the various provinces; and a certain number of topographic, geographic, and reconnaissance maps of special areas.

Plans

In addition to the township development plans previously mentioned, there are also distributed by the Bureau plans of townships, townsites, and of settlements. The township plans are on a scale of one-half mile to the inch and show the monuments established to mark the boundaries of sections, and the bearings, measurements, and areas of all quarter-sections, besides the main topographic features. Townsite plans have been issued on a scale of two hundred feet to the inch for townsites surveyed on Dominion lands. The settlement plans cover similarly areas of settlement on Dominion lands that have been surveyed beyond the limits of the regular Dominion Lands System of survey. These plans are not listed in the catalog.

MAPS ISSUED BY THE GEOLOGICAL SURVEY, BUREAU OF ECONOMIC GEOLOGY, DEPARTMENT OF MINES, OTTAWA

The Geological Survey of the Dominion government is no doubt responsible for the major portion of the geological maps issued in Canada, though certain ones of the provincial governments--as may be seen further on--also are important publishers of such maps. An excellent annotated catalog[3] is, moreover, available for all the publications issued between 1845 and 1917 by the Geological Survey of the Dominion Government. This catalog has since been brought up to date, as far as the Survey's map publications are concerned, by a supplementary list,[4] issued in 1934.

CHART PUBLICATIONS OF THE CANADIAN HYDROGRAPHIC SERVICE, DEPARTMENT OF MARINE, OTTAWA

The marine charts of the Hydrographic Service have been principally prepared from the results of original surveys conducted by the Service since its inception in 1883, and also from compilations of survey work, charts, and plans furnished by other departments of the Canadian government, and by the British and foreign hydrographic offices. The charts have been constructed, with few exceptions, on a conical projection, with the scale based on the

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[3]W. F. Ferrier, Annotated Catalogue of and Guide to the Publications of the Geological Survey of Canada, 1845-1917 (Ottawa, 1920). Pp. 544.

[4]Canada. Geological Survey. Published Maps (1917-1934 inclusive). Compiled by P. J. Moran (Ottawa, 1934).

length of a nautical, or geographical mile. The scales vary considerably, however, according to the use which is to be made of the charts. New charts and new editions of the present coastal charts are gradually being brought to a uniform basis and constructed on the Mercator projection. The scales of coast and marine charts, in so far as is practicable, are being standardized at one inch, one-half, three-tenths, and one-tenth inches to the nautical mile, in order to facilitate the use of a number of such consecutive charts in series.

The various types of marine charts issued by the Hydrographic Service may roughly be grouped as follows:

a) Charts for general navigational purposes:

(1) of the Atlantic Coast (including the St. Lawrence River to the head of ocean navigation at Montreal);
(2) of the Great Lakes and Inland waters;
(3) of the Pacific Coast:

b) Charts for special purposes.

A detailed catalog[5] with numerous key-index charts is issued by the Hydrographic Service for these charts, perhaps biannually. This catalog also lists publications useful to mariners issued by other departments of the Dominion government, of which may be mentioned, by way of example, the canal charts published by the Department of Railways and Canals, Ottawa. A list of British admiralty charts, affecting Canadian waters, is also appended.

## II. Maps and Map Lists of the Provincial Governments

ALBERTA (Edmonton)

Department of Public Lands and Mines

Maps of the province, on various scales; some maps of districts; also township plans of each surveyed township in the province, are issued by the department.

Bibliographical Aids

No published list of the maps distributed by the department is presently available (March 1935); but it is planned, at an early date, to have certain new issues of maps published, after which a list will be prepared.

It should be noted that prior to October, 1930, responsibility

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5Canada. Department of Marine and Fisheries. Catalogue of Marine Charts, Sailing Directions, and Tidal Information, issued by the Canadian Hydrographic Service, and other Canadian Government publications of interest to mariners; corrected to April 1, 1932 (Ottawa, 1932).

| ALBERTA (Edmonton) (Cont.) | Bibliographical Aids |
|---|---|
| Department of Public Lands and Mines (Cont.) | for the mapping of the province was with the Dominion government at Ottawa. |
| Department of Public Works | |
| Three maps of the province, on a scale of ten miles to the inch, and differing from one another mainly in topographical detail, were published in 1930. These are the only maps of the department, and no reissue is contemplated before 1936. | No special list of these maps is published by the department. |
| Research Council of Alberta (University of Alberta) | The Research Council of Alberta was founded in 1921 as "The Scientific and Industrial Council of Alberta." The title was shortened to the present one in 1930. |
| Numerous geological maps have been published supplementary to the thirty reports that have thus far (1934) been issued by the Geological Survey division of the Research Council. Some maps have also been included in the reports on fuels, and on soil surveys. | A list of the geological survey reports, with maps, as well as of the remaining publications of the Research Council is obtainable from the University of Alberta--the seat of the Council. |
| BRITISH COLUMBIA (Victoria) | |
| Department of Lands (Survey Branch) | |
| Issues: | |
| a) Various series of geographical maps | A printed, one-sheet List of Lithographed Maps is available for these maps from the Chief-geographer. |
| b) Mineral reference maps<br>(The maps show mineral claim surveys; they are mostly on the scale of 1,500 feet to the inch.) | A list of Departmental Mineral Reference Maps is available from the Surveyor-general in the department. |

| | Bibliographical Aids |
|---|---|
| BRITISH COLUMBIA (Victoria) (Cont.) | |
| Department of Lands (Cont.) | |
| c) Department reference maps<br>(The maps show lands alienated and applied for, etc., surveyed and unsurveyed; they are mostly on the scale of one mile to the inch.) | A printed, one-sheet List of Departmental Reference Maps is available from the Surveyor-general in the department.<br>The maps were originally prepared for departmental use only, but are now available to the public. |
| d) A New Wall Map of British Columbia (1933)<br>(Scale 1:1,000,000. The map is in four sections. It replaces the previous official map of the province, issued in 1912.) | |
| MANITOBA (Winnipeg) | |
| Department of Mines and Natural Resources<br>Issues:<br>Maps of the province, its forest reserves, organized municipalities, roads, townsites, and provincial electoral districts. | A mimeographed, one-sheet "List of Maps and Plans," is available from the director of the surveys branch.<br>It should be noted that most of the maps used by the department are those published by the Topographical Survey, and the Department of Mines of the Dominion government; their catalogs should also be consulted. |
| NEW BRUNSWICK (Fredericton) | For the maps of this province consult the catalogs issued respectively by the topographical and geological surveys of the Dominion government. |
| NORTHWEST TERRITORIES | |
| The mapping of these territories is entirely the concern of the Dominion government at Ottawa. | For these territories see the map catalogs issued respectively by the topographical and geological surveys of the Dominion government. |
| NOVA SCOTIA (Halifax) | |
| The mapping of this province is entirely the concern of the topographical and geological surveys of the Dominion government. | For the maps of this province see the catalogs issued respectively by the topographical and geological surveys of the Dominion government. |

| | Bibliographical Aids |
|---|---|
| ONTARIO (Toronto) | |
| Department of Highways | |
| County road maps on the scale of four miles to the inch are available for all the counties of the province. | No list of this department's maps is published. |
| An annually revised road map of the whole province is also issued for motorists. | |
| Department of Lands and Forests | A printed, one-sheet List of Lithographed Maps and Plans is available from the Department of Surveys, Parliament Building, Toronto. |
| The maps issued by this department are exclusively geographical in nature. | |
| Department of Mines | |
| An average of six or more geological maps are issued by the department, annually. | These maps are completely listed in Bulletin No. 25 (third edition, revised to May, 1932) issued by the Ontario Department of Mines, and entitled List of Publications Including Reports (Vols. I-XL, 1891-1931), Maps, and Bulletins. A recently published supplement brings this list up to date through August, 1934. Bulletin and supplement may be obtained from the department. |
| PRINCE EDWARD ISLAND (Charlottetown) | For maps of this island consult also the catalogs issued respectively by the topographical and geological surveys of the Dominion government of Canada. |
| Map of Prince Edward Island indicating motor roads and recreational resources (1929) (Scale five miles to the inch. The map was prepared by the Natural Resources Intelligence Service, Department of the Interior, Ottawa.) | |
| QUEBEC (Quebec City) | |
| Department of Lands and Forests (Surveys Branch) | A printed, two-page List of Maps published by the Surveys Branch is available from the department. A key-index map is also issued. |
| Issues mostly county maps | |

| | Bibliographical Aids |
|---|---|
| QUEBEC (Quebec City) (Cont.) | |
| Ministère de la Colonisation, de la Chasse, et des Pêcheries (Service du Cadastre) | |
| Lithographed maps in either one or two sheets, on the scale of one mile to the inch, are issued for each county of the province; similar maps for most of the townships are available on the scale of one-fourth mile to the inch. | For these maps there is available from the Ministry of Colonization at Quebec a detailed booklet of sixty pages, entitled Liste des Villes, Villages, Paroisses et Cantons Cadastrés de la Province de Quebec. The list has been prepared by A. J. Duchesnay. It was published in 1930. |
| SASKATCHEWAN (Regina) | |
| Department of Highways | |
| An annual highway map of the province, in lithographed folder form, on the scale of ten miles to the inch, is the only map issued by the department. | No map list is published by this department, but information regarding its map may be obtained from the deputy-minister. |
| Department of Municipal Affairs | |
| White or blue-print plans are available of:<br>a) All the rural municipalities in the province, on the scale of one mile to the inch.<br>b) All the villages and towns of the province, on the scale of 200 feet to the inch.<br>A lithographed map showing the boundaries of all rural municipalities, on the scale of sixteen miles to the inch, is available of southern Saskatchewan. | No list of the department's maps or plans is issued; but it has available a blue-print list (1935) of the rural municipalities in the province, and a small blue-print map (1934) showing the municipal divisions of the province. Inquiries respecting maps or plans should be addressed to the director of town-planning, in the department. |
| Department of Natural Resources | |
| Blue-print base maps on the scale of eight miles to the inch are available for the southern and the central portion of the province. | No separate list is published for these maps by the department. Information regarding them may be obtained from the surveys branch |

SASKATCHEWAN (Regina) (Cont.)

Bibliographical Aids

Department of Natural Resources (Cont.)

A new lithographed base map, in colors, of southern Saskatchewan, has just been issued. It is on the scale of sixteen miles to the inch, covers townships one to sixty-two, and shows highways, provincial forests, and provincial parks. This map is also available through the topographical survey bureau of the Dominion government.

YUKON TERRITORY

Responsibility for the mapping of the territory rests entirely with the Federal government at Ottawa.

Consult the catalogs of the topographical survey and of the department of mines--both of the Dominion government--for maps of this territory.

# CHAPTER XIII[1]

## PRESENT STATUS OF TOPOGRAPHIC MAPPING IN LATIN AMERICA

Topographic mapping in the Latin American republics is still so fragmentary that it will be many years before even the areas most important from the standpoint of settlement and natural resources will be covered by large scale maps. Fortunately, the need for such maps is pressing in only a few areas. The greatest want is of a general map of sufficiently large scale to be serviceable as a base for reconnaissance work in the field, for detailed plotting of distribution phenomena, and for general reference purposes.

Such a map has now been made available through the completion by the American Geographical Society of a map in 102 sheets, on the scale of 1:1,000,000, covering all of Mexico, Central and South America, and the West Indies, that is, some 12,000,000 square miles of land and sea. This unique "Map of Hispanic America" marks the consummation of fifteen years of exhaustive examination of all the published surveys and of much unpublished material stored away in government archives and in the collections of foreign and domestic construction and development companies. In general make-up and standard the map conforms to the International Map of the World on the millionth scale. One of its valuable features is the addition to each map sheet of a "reliability diagram" showing the areas covered by surveys and the type of survey. A source book detailing the material used in the compilation of the map is in preparation.

An invaluable by-product resulting from the assembly of material for the map is the Catalogue of Maps of Hispanic America, in four volumes, which was published by the American Geographical

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[1]This chapter is entirely based on the summaries of Latin American cartography contributed by Mr. Raye R. Platt to the Handbook of Latin American Studies (Cambridge: Harvard University Press, 1936). Acknowledgments are due to Mr. Platt and to the editor of the Handbook, Dr. Lewis Hanke, for permission to use this material.

Society from 1930 to 1932.[2] It lists not only separately published maps but also the maps included in books and periodicals.

The present status of topographic mapping in the individual Latin American republics is briefly summarized below.

## 1. Argentina[3]

The chief official mapping bureau of the Argentine republic is the Instituto Geográfico Militar. It is presently engaged in work on the following three major projects: triangulation and precise leveling; topographical surveys for a general map of the whole country, on the scale of 1:100,000; and a detailed topographical survey of areas of particular military and administrative importance, on scales of 1:25,000 and 1:50,000. Precise leveling has now been extended to the province of Buenos Aires and the southern part of the provinces of Santa Fé and Corrientes as far north as the 30th parallel. About one hundred sheets on the scale of 1:25,000, and some fifty sheets on the scale of 1:50,000 have been published. The former sheets cover an area measuring six minutes of latitude and longitude, and the latter an area extending over twelve minutes of latitude and longitude. The territories covered by these large scale sheets lie scattered about the provinces of Buenos Aires, Santa Fé, Corrientes, Entre Ríos, Mendoza, and Salta.

The long felt want of an official general map of the Argentine republic also has now been met by the Instituto Geográfico Militar. This map is on the scale of 1:500,000 and consists of some eighty sheets. Except for the representation of relief, which is done by shading, the map appears to be an excellent compilation.

Finally, the Dirección de Minas, Geología e Hidrología is engaged in triangulation work and topographic surveys by rapid

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[2] A valuable list of maps of Latin America issued during 1935 has been compiled by Mr. Platt for the Handbook of Latin American Studies, op. cit., pp. 61-66.

[3] See also the recent and comprehensive map list by Roberto Pusch, Catalogo de mapas, planos y croquis de la Republica Argentina y parte de los paeses limitrofes...Primera parte: Provincia de Buenos Aires y zona limitrofe (Buenos Aires: Ministerio de Agricultura. Dirección de Minas y Geología. "Publication No. 108," 1935). Pp. 120.

methods including photo-stereoscopic surveys for a so-called "geological-economic map," of which a number of widely scattered sheets, mostly of the Andean region, have been published.

2. Bolivia

Compilation of a general map of Bolivia, based on all the existing cartographic data, was commenced by the Bolivian government shortly before the outbreak of the war with Paraguay. Scheme and standards adopted for this map were those of the International Map of the World on the millionth scale, although the published sheets were designed to be on a larger scale, probably 1:500,000. It is understood that this compilation is now completed. It is not believed, however, that the map has as yet been published, though the American Geographical Society has been supplied with offsets of the final drawings of a number of the sheets. They appear to be of uniformly high quality and present, moreover, evidence that a considerable amount of new survey work has been done expressly for this map in such areas where the existing cartographic data alone was inadequate.

3. Brazil

Although the Federal government of Brazil has no general topographic mapping program of its own, survey work has been engaged in for many years by the Serviço Geológico e Mineralógico in the state of Sao Paulo, and by the Commisao Geográphica e Geológica in the State of Minas Geraes. Of Sao Paulo have been published thus far thirty-two sheets or about one-third of the total number of sheets required to cover the whole state on the scale of 1:100,000; of Minas Geraes have been issued forty sheets which cover some 75,000 square miles in the south-eastern corner of the state.

It should be noted that between 1922 and 1924 the Engineering Club of Rio de Janeiro compiled and published the complete set of forty-four full and partial sheets, representing Brazil's portion of the International Map of the World on the scale of 1:1,000,000. Due largely to the haste with which the map was produced, it falls below the standards set for the international map. For example, contours are roughly plotted even for areas where good topographical surveys were available, and no distinction is made between surveyed and unsurveyed rivers and contours.

## 4. Central America

None of the Central American republics is engaged on general mapping projects of any sort. There has now been made available, however, a map in thirty-four sheets, on the scale of 1:250,000, which covers all of these republics. The map is the work of the Geographic Branch, Military Intelligence Division, U. S. War Department. It gives good details of drainage, boundaries, settlements, and roads, at least insofar as the underlying source material permitted. But its value would have been greatly enhanced if the quality of this material had been indicated on an accompanying "reliability index," and if relief had been shown by contours or formlines instead of hachures.

For Panama and the Canal Zone there has been in progress since 1916 a "military survey" by the Corps of Engineers, U. S. Army. By the end of 1935 the completed surveys extended over some 4,855 square miles. They include the Canal Zone, an irregular area east of that Zone and stretching south as far as Chepo (forty miles from the Canal), and a broad strip along the Gulf of Panama reaching westward to Santiago, about one hundred and sixty miles from the Canal. It may also be noted that the government of Panama, in 1924, adopted as its official map a reproduction of the drawings which had been prepared for the Panama and Barranquilla sheets of the American Geographical Society's "Map of Hispanic America." Both drawings and official map are on the scale of 1:500,000.

Of Nicaragua there has been produced by the U. S. Marine Corps a map on the scale of 1:150,000, which was chiefly compiled from traverses, aerial photographs, and sketches made by the Corps' own personnel. The map is without contours, and makes use of hachures to indicate the principal mountain ranges and peaks. Drainage is in most sections considerably generalized; but settlements, roads and trails are shown in great detail.

## 5. Chile

In Chile two official organizations are engaged on programs of triangulation and topographic survey; they are: the Inspección de Geografía, of the ministry of public works, and the Instituto Geográfico Militar. The first of these has thus far confined its activities to the northern part of the country where

a few sheets of a map on the scale of 1:25,000 have been produced of the region around Iquique. It also has compiled a number of sheets on smaller scales, such as 1:100,000 and 1:200,000, of important mineral areas. The second, the Instituto Geográfico Militar, is primarily concerned with the production of a military map of the country. This map is on the scale of 1:25,000 and now covers the large territory extending from the Central Valley to the coast southward from the vicinity of Santiago.

The best official general map of Chile is still the map on the scale of 1:500,000, in twenty-two sheets, which was compiled and published between 1908 and 1911, by the Oficina de Mensura de Tierras, although it is now out of date in many respects.

## 6. Colombia

The mapping of the departments and intendencias or national territories of Colombia has been for a number of years the concern of the Oficina de Longitudes, a bureau in the ministry of foreign relations. Separate maps of all the departments, and one map of the Intendencia del Chocó, have now been published on the scale of 1:500,000. The maps are based on astronomical positions determined by the Oficina de Longitudes and are in part compiled from surveys, mostly route and river traverses, made expressly for them. In addition the compilers had access to a great deal of official and original source material which is not readily available to non-official workers. Still, the maps vary considerably from section to section with respect to rigidity of astronomical control and topographic detail. In general they are rather indifferent compilations, for much of the existing material has been ignored or badly used. Surveyed and unsurveyed areas are not distinguished and relief is shown by a type of hill shading that gives no real indication of its character.

Only passing mention need be made of the Carta Militar, the surveys for which were begun in 1903 by the cartographic section of the general staff of the Colombian army. Eight sheets of the map had been issued by 1920; they cover about ten square miles in the city of Bogatá and environs. No other sheets have been published and this project appears to be abandoned.

## 7. Ecuador

Although the government of Ecuador organized several years ago a geodetic commission whose ultimate purpose was the production of a topographic map of the whole country, no sheet of this proposed map has been published so far. It was also announced at about the same time that the government had accepted for publication as its official map a compilation on the scale of 1:100,000, prepared by Luis Telmo Paz y Mino, a former chief of staff of the army. So far no sheets of this map appear to have been issued. It may be stated, however, that the map in manuscript which was compiled in large part in the offices of the American Geographicl Society by Paz y Mino, had all the earmarks of an excellent compilation.

## 8. The Guianas

None of the colonial governments of the Guianas is engaged on a program of topographic mapping. In British Guiana the Department of Land and Mines has published a number of fairly good compiled maps of the whole colony. In Suriname (Dutch Guiana) practically the entire colony, except for the extreme southern part, has been covered by surveys carried out by various expeditions, mostly official, from the Netherlands. As a result compiled maps of the colony are in general of excellent quality. Unfortunately, none of the many surveys that have been made in this colony has produced a contoured map of any section of it. Little survey work of any sort has been done in French Guiana and compiled maps of the colony are consequently of poor quality.

## 9. Mexico

No program of systematic topographic mapping has been instituted in Mexico, although plans for the creation of a central federal government mapping bureau have been discussed recently. There are, however, a number of mapping projects in which government departments had a share. The activities of two of these departments may be singled out for special mention; they are the Comisión Geográfica Exploradora, ana the Dirección de Estudios Geográficos y Climatológicos.

The mapping activities of the Comisión fall within the period dating from 1897 to 1911. They gave rise to a large number

of map sheets on the scale of 1:100,000, compiled chiefly from route and river traverses, barometrical determination of altitudes, and astronomical ascertainment of positions. The area covered by these maps extends over some hundred thousand square miles bordering on the Gulf of Tehuantepec and including a part of the more densely populated sections. Although this is still the best available map for a considerable portion of the area, it falls far short, in detail and accuracy, of the quality one would expect to find in a map on so large a scale. Between the traverses, which in some sections form a fairly close network and in others are only a few widely separated lines, the map is at best only a rough sketch. The contours, plotted at hundred-meter intervals, are really formlines only, drawn in the drafting room on the basis, chiefly, of an extremely small number of barometrically determined altitudes; they serve therefore little more than to distinguish in a general way between highland and lowland. This project was, moreover, abandoned in 1911.

The Dirección, in the ministry of agriculture, is credited with the production of two series of state maps, one on small scales, and another on larger scales. The maps of the first series were compiled mostly on the scale of 1:500,000 and had relief indicated by hachures only. Such maps were issued for the states of Sonora, Chihuahua, Coahuahua, Coahuila, and Durango. This project was abandoned and superseded by another series of state maps on the scales of 1:100,000, 1:200,000, and 1:500,000, with relief now indicated by contours. Maps of this series have been published of the states of Aguas, Calientes, Hidalgo, Jalisco, Mexico, and Chiapas. They appear to be rather good compilations. Their chief weakness is that they do not distinguish between data obtained from actual field surveys and data gathered indirectly from material that frequently was of little reliability. Contours on these maps are for the most part formlines only; but they appear to be so much more carefully drawn than those on the 1:500,000 maps that they give some real indication of the topographic character of the features they delineate.

## 10. Paraguay

So far as is known, the government of Paraguay has no program of topographic mapping. Such compiled maps as exist of the country are, in general, of very poor quality.

## 11. Peru[4]

Work on the Carta Nacional of Peru, on the scale of 1:200,000, has progressed steadily since its inception in 1925. The map is being prepared and published by the Servicio Geográfico of the Peruvian army. It is in all respects a thoroughly modern topographic map based on good triangulation.

Of the forty-five map sheets which had been issued of the map by the end of 1935, thirty-four cover a broad band of territory along the coast from the mouth of the Tumbes River to Punto Lobos south of Lima, and thence extending south to latitude 6°24' as far east as the Maranon River and the Cordillera Blanca. A single sheet is given to the portrayal of the Arequipa region, and the ten remaining sheets cover a band of territory reaching from the coast at the new boundary with Chile north to Lake Titicaca. A distinction is made on these maps between perennial and intermittent streams, and the character of the roads and the gauge of railways is also indicated. Cities and towns are plotted in plan wherever possible, and isolated houses and house groups are shown by dots. The only criticism of the map is that it is rather crowded with detail. This is particularly noticeable in case of the contours which represent fifty-meter intervals and are in many places difficult to follow.

## 12. Uruguay[5]

In Uruguay the Servicio Geográfico Militar is engaged on a program of triangulation and topographic mapping. To date only a few map sheets have been issued of the city of Montevideo and environs, on the scale of 1:20,000 and 1:50,000.

## 13. Venezuela

No official general map of modern design is available either of Venezuela as a whole or of any large portion of it. Work on a topographic map, styled at first Plano Militar, was

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[4]See also, K. Lassanske, "Der Stand der peruanischen Landesaufnahme," Petermanns Mitteilungen, LXXXI (1935), 81-84.

[5]For a layout of the new survey of Uruguay and the completed quadrangles, see B. Carlberg, "Die Karte von Uruguay in 1:50,000," Petermanns Mitteilungen, LXXXI (1935), 200.

begun in 1905. With the initiation, in 1905, of a program of triangulation, this name was changed to Mapa Físico y Politico. Progress on the map came to a stop, however, during the world war, by which time a few uncontoured map sheets of the vicinity of Caracas had been drafted. No other sheets have been issued and no further work has been done on the map.

14. West Indies

The island of Cuba is completely covered by a map prepared and published between 1906 and 1908, by the U. S. War Department, on the scale of one inch to the mile with contour lines at fifty-foot intervals. The map falls far short, however, of the quality to be expected of a map of this scale and general appearance. Except for the addition of certain field corrections and of contour lines, the map is, in fact, an enlargement from a Spanish military map. No astronomical or trigonometrical control was established, and elevations for the plotting of contours were determined only by approximate methods. The Cuban government has now revised these sheets, although only with respect to roads and settlements and administrative boundaries. The government has also issued a number of sheets of a topographic survey on the scale of 1:10,000 covering the vicinity of Havana.

Of the island of Jamaica only four topographic map sheets have been made available. They were issued in 1920 and cover Kingston and its environs. The scale is two and one-half inches to the mile.

Neither Haiti nor the Dominican republic has an active topographic mapping program. Of the latter country, however, the U. S. Geological Survey has produced eight full and partial sheets of a topographic map on the scale of 1:100,000, which cover about one-fifth of the terrain north and west of Santo Domingo.

Of Puerto Rico the U. S. Geological Survey published in 1935 six map sheets on the scale of 1:25,000 which portray a small section of the southwest corner of the island.

The Virgin Islands of the United States have been surveyed by the U. S. Geological Survey and the results published by the U. S. Coast and Geodetic Survey in 1921. The maps are on the scale of 1:100,000.

Of Trinidad and Tobago the Colonial section of the Ordnance Survey of Great Britain has completed and published a map on the

scale of 1:50,000.

Finally, the Dutch islands of Curaçao, Aruba, and Bonaire have all been completely covered by topographic maps on the scale of 1:20,000.

## CHAPTER XIV

## OFFICIAL MAP PUBLICATIONS OF GREAT BRITAIN

The chief map issuing agencies of the British government are the following: The Ordnance Survey Department; the Geological Survey Department; the Geographical Section of the General Staff, War Office; and the Hydrographic Department. A brief description of the map publications and the map lists for which each of these agencies is responsible is given in what follows.

### THE ORDNANCE SURVEY DEPARTMENT

In England, as in all western Europe, a combination of astronomical and military needs gave the first impetus to topographic mapping; but military necessities proved the dominating influence. The official mapping of the British Isles dates from the rebellion in the Scottish Highlands in 1745. It gave occasion to the first elaborate compass sketch with hachured hills, by Lieutenant-General Watson, which was afterwards extended over the whole of Scotland and became the first official map of that country.[1] The original sheets are in the British Museum; they are on the scale of 1:36,000, and the reduction of them on a single sheet was published by General Roy, who had taken a large part in the work, in his Military Antiquities.

In 1765 Roy was appointed Surveyor-General of Coasts and Engineer for making and directing military surveys in Great Britain. In 1783 he began triangulation between London and Dover for the geodetic connection of the observatories of Greenwich and Paris, measuring the base on Houslow Heath in the following year. This was the beginning of really accurate surveying in England. On Roy's death in 1790, the Duke of Richmond, Master General of the Ordnance, resolved that the work thus begun should be continued; and on July 10, 1791, he appointed two artillery officers to carry on the trig-

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[1] See Charles Close, The Early Years of the Ordnance Survey (Chatham, 1926); see also the same author's later work, entitled The Map of England, or about England with an ordnance map (London: Peter Davies, 1932).

onometrical survey. The Ordnance Survey dates, therefore, from 1791, and its first map of Kent and southern Essex, in four sheets on the scale of one inch to the mile, was published on January 1, 1801. These map sheets were engraved in black and white, while physical features were shown by hachures supported by spot heights. It may be noted that this map on the one-inch scale came to be the standard map of Great Britain, and that it was not until 1824 that the work of the Ordnance Survey was expanded to include maps on larger scales.

The Ordnance Survey is, in fine, a government department, partly military and partly civil in makeup, which has as its major objective the preparation of certain standard maps. It does not collect data on economic resources, or compile geologic, mining, or agricultural maps, although it prints these. Unlike the U. S. Geological Survey, the Geological Survey of Great Britain is distinct from the topographical survey. In fact, the topographic map of Great Britain is the primary and almost sole concern of the Ordnance Survey.

The Ordnance Survey maintains its headquarters at Southampton and has four field divisions located respectively at Edinburgh, York, Norwich, and Bristol, where the actual field work and the drawing of the large scale revision is carried out. That the Survey is located at Southampton and not at London is explained by the accidental destruction, in 1841, of the Ordnance Survey Offices in the Tower of London which resulted in the removal of the Survey to Southampton where certain barracks under the control of the Board of Ordnance were available. The name of "Ordnance Survey" is explained by the fact that the Survey was at first placed under a Master General of Ordnance and a Board of Surveys. The name derived from this association has been retained permanently.

Until April, 1922, the Ordnance Survey at Southampton prepared and sold the maps of the whole of the United Kingdom. But on that date the surveys of Northern Ireland and of the Irish Free State were handed over to their respective governments, and these governments have since that time prepared and issued their own topographic and geologic maps and catalogs.

There are also to report some very significant recent changes in the technical make-up of some of the Ordnance Survey's maps. These are notably the change from the Cassini projection to the Transverse Mercator or Gauss Conformal projection, in 1927; the introduction, at that same time, of a "National Grid" upon

the Ordnance Survey's small scale maps; and the adoption, in April, 1929, of the new datum of Newlyn to replace the inaccurate datum of Liverpool which had served since 1844 as Great Britain's reference base for altitude determinations. Since the difference in altitude between the old and the new datum is not the same for all localities, it has been decided to show the local differences on all the Ordnance Survey six-inch and twenty-five inch scale maps, beginning with April, 1929. The levels of each county are being referred to the new datum just as fast as the county maps come up for revision.

Another fundamental change was the adoption in 1927 of the Transverse Mercator or Gauss Conformal projection in place of the Cassini projection.[2] Practically all the maps of England and Wales had been previously on this projection. In Scotland, with the exception of the quarter-inch map, the small scale maps were plotted on the Bonne projection. The result was that the Bonne maps of Scotland and the Cassini maps of England and Wales could not be joined together. Now England and Wales and Scotland all have the same projection and the same prime meridian and their maps form a homogeneous whole. The prime meridian to go with the new projection was selected two degrees west of Greenwich, and the parallel of reference was taken to be the forty-ninth.

The change in projection also afforded an opportunity to introduce a "national grid" upon the maps of the Ordnance Survey. It is true, of course, that the Survey's small scale maps in popular use were already provided with a system of squares, in all cases two inches wide. But these squares did not form a geographical grid because such a system must consist of squares which extend over the whole area of a country and must be independent of the individual sheets of the map. The squares on the Survey maps did not satisfy this condition, for they were dependent on the sheets they covered and had no direct relation to the squares of the adjoining sheets. The "national grid" of Great Britain was adopted in 1927; its unit of length is the distance of a thousand yards. It is now to be seen on all the existing sheets of the new Fifth Edition of the one inch or standard topographical map of Great Britain; on about half of the number of sheets issued of the new

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[2]See the article by H. S. L. Winterbotham, "The Small-Scale Maps of the Ordnance Survey," Geographical Journal, LXXIX (Jan., 1932), 17-31.

quarter-inch map (fourth edition); on the provisional three-inch map of London; on the new half-inch map of "Greater London," and on the various indexes which accompany the maps. The Ordnance Survey's mapping policies are evidently in a state of transition, so that further changes in the technical make-up of its maps may perhaps be expected.

## Map Publications of the Ordnance Survey of Great Britain *

The regular map publications of the Ordnance Survey fall into two separate groups of maps designated respectively as "small scale maps," and "large scale maps." A descriptive handbook with map specimens, symbol sheet, and diagrams is available from the Director General of the Survey for each of these map series.

It is noteworthy that the series of topographical and cadastral maps provided by the Survey are the most comprehensive to be found anywhere. Great Britain not only has a complete set of cadastral maps, but the whole country is covered by this type of map in a uniform series, published and available at small cost, and systematically revised. A brief description of the individual maps comprised within the small and large scale series is attempted in the following pages.

## The Small Scale Maps[3]

The regular map publications coming under this heading are on the scales of:

One Inch to One Mile (1:63,360)
Half Inch to One Mile (1:126,720)
Quarter Inch to One Mile (1:253,440)
One Inch to Ten Miles (1:633,600)
One Inch to 15.782 Miles (1:1,000,000 or 1:M)

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[3]For these small scale maps consult the Survey's special handbook, entitled, Great Britain. Ordnance Survey. A Description of the Ordnance Survey Small-Scale Maps (8th ed.; Southampton, 1935); this gives a complete description of all these maps, together with indexes, characteristic symbols and twenty specimen portions of typical maps printed in full colors. Abridged lists (folders) of these maps are also distributed by the Ordnance Survey at more frequent intervals. The Geographical Journal, and its Supplement which is a separate list of the geographical literature and maps added to the Royal Geographical Society's collections, and the Scottish Geographical Magazine, should also be currently consulted with respect to new map publications.

*On these maps see especially the recent work by Brigadier H.S.L. Winterbotham, A Key to Maps (London and Glasgow, 1936).

## The One Inch to One Mile Maps (1:63,360)

### Fourth (Popular) Edition

This is the most detailed and complete set of the small scale maps; it is the principal topographic map of Great Britain. It is based on the third field revision of the country made between 1914 and 1925. The publication of a revised, or fifth, edition on this scale was commenced in 1931; but it will require perhaps fifteen more years to complete this map for the whole country.

The fourth, or popular, edition is in colors and has contour lines representing 50 feet vertical intervals. All the essential features of the country are shown. The size of the normal sheet is 28 x 19 inches, with allowance for an overlap of one inch in all directions.

Up to 1927 the 92 map sheets on this scale which cover Scotland were based on a projection and meridian different from those employed for the 146 map sheets covering England and Wales. It is significant to note that the new Scottish map has been transferred to the English projection and Meridian and that the sheet lines of the English popular edition have been carried through into Scotland, thus eliminating the confusion formerly existing on the border.

### Fifth (Relief) Edition

This is a new map. The first sheet was issued in 1931; it will require many more years to complete this map for the whole of Great Britain. At present, the map is about one-fourth complete, most of the sheets covering Devon and Cornwall having been published, with a number of sheets of the suburbs of London also available. This new map is not merely a revised version of the fourth, or popular, edition. It is plotted on the Transverse Mercator projection and is provided with national grid lines. Perhaps the most striking difference between this and the popular edition is the introduction on the new map of hill shading and "layer" tints, which give the map a marked appearance of modeling. The map is also no longer based on engraved copper plates but is drawn for reproduction by the photographic process known as helio-zincography. The net result is an artistic map, easy to read as regards hill features, and improved with respect to nomenclature. The size of each sheet measures 29 x 17 1/2 inches.

An edition of this series is also being published without the hill-shading and layer tints. This is known as the "Fifth Edition." An "outline" edition, comprising outline, water and contours printed entirely in black, and another edition showing physical features only, are also to be issued.

### Outline Edition

This is an edition of the revised one inch map prepared for those who require an outline map for engineering and related purposes. The sheet lines are the same as those of the popular edition. Outline is shown in black, water in blue, and contours in red.

The One Inch to One Mile Maps (1:63,360) (Cont.)

Engraved Black Outline Series

This series is based on the second field revision of the country made between 1901 and 1912. England and Wales are covered by 347 sheets measuring 18 x 12 inches, and Scotland by 131 sheets, measuring 18 x 24 inches. Parish boundaries are delineated.

"District" maps of England and Wales

These sheets are designed to be of service to towns and districts which are not sufficiently well shown on the map sheets of the regular series. All the 33 maps of the series, except 6, are in the style of the popular edition.

"Tourist" Maps

These maps cover all the better known tourist resorts and districts of special interest. Much information not shown on other maps is incorporated in these maps. The size of the individual sheet depends on the extent of area it is made to cover. While most of the current maps of this series are in the style of the popular edition, future editions will be modeled after the Fifth (Relief) edition.

"Land Utilization" Maps of Great Britain

These maps have as their base the sheets of the Fourth, or popular one inch edition. The work of compiling the land utilization data and of transferring it upon the maps is done entirely under the auspices of the London School of Economics and the Geographical Association, as directed by L. Dudley Stamp. The whole of Great Britain is to be covered by these maps. Some sheets have already been published and may be obtained from either the Ordnance Survey or from any bookseller.

London Passenger Transportation Map

This map is in 12 sheets showing: city, county, police, passenger transport and traffic areas, etc., of London and environs. The base maps are the outline maps of the Fourth or popular edition. This transport map is available in three different styles, depending on the color employed in the delineation of boundaries, roads or road numbers.

"Main Roads of London"

A one-sheet diagram showing the chief traffic routes of London.

The Half Inch to One Mile Maps (1:126,720)

The Regular Map Series

This map is primarily intended for the motorist and cyclist. The features shown are substantially the same as those on the one inch maps. Relief is shown by means of layer tints of various shades of green and brown. Contour lines on the 40 sheets of this map covering England and Wales are drawn at 50 feet, 100 feet, then at intervals of 100 feet to 1000 feet, and above that at every 250 feet. On the 34 sheets of Scotland contours are shown in brown at 50 and 100 feet and thence at all 100 feet intervals. Each normal sheet of the Scottish

The Half Inch to One Mile Maps (1:126,720) (Cont.)

The Regular Map Series (Cont.)

series measures 24 x 18 inches, and each similar sheet of the English series 27 x 18 inches. The sheets covering Orkney and Shetland Islands and Hebrides are not published in the "layered" edition but are available with hills shaded.

"District" Maps

Maps of this series in the style of the Fifth (Relief) edition of the one inch map have been published for "Greater London," the Cotswolds, and Birmingham and district. See above, under "district" maps for an explanation of the nature of these maps.

County Administrative Maps

Maps of this series are published for each county. They show the boundaries of all rural and urban districts, municipal and county boroughs, civil parishes, parliamentary boroughs and county divisions. An edition of these maps is also published in outline with the parish boundaries in red.

Outline Edition

A plain black outline edition of England and Wales, on paper, unmounted, is available.

The Quarter Inch to One Mile Maps (1:253,440)

The Regular Map Series

This is the standard Ordnance Survey motoring map of the country. Each sheet covers a large and convenient area. The maps are constantly being revised with respect to roads and road symbols. Relief is shown by contours and "layer" coloring. Traffic diagrams of the principal towns are bound up with each sheet.

Scotland is covered by 9 sheets; the border sheet (sheet No. 1) is common to both Scotland and England and Wales. All of the 11 sheets of this map covering England and Wales have now been issued in the new Fourth Edition, which replaces the Third Edition. The system of layer coloring has been improved; woods are shown in green.

Outline Edition

This edition is published with outline in black, water in blue, and contours omitted.

Aviation Maps: Civil Air Edition

The standard flying maps of the country are issued on the scale of one quarter inch to one mile, or one inch to four miles, and on the scale of one inch to ten miles. The first of these, the quarter inch map, is issued in 12 sheets. Railroads, main roads, woods, inland water and high ground are strongly emphasized; and landmarks such as golf courses and race tracks are clearly marked. Aerodromes, direction finding stations, landing fields, radio-stations, beacons, and danger areas, etc. are shown by symbols boldly printed in red.

The Quarter Inch to One Mile Maps (1:253,440) (Cont.)

Aviation Maps: Civil Air Edition (Cont.)

Similar map sheets are available for Scotland, which is covered by 9 sheets. The map is constantly revised. The air maps on the scale of ten miles to the inch are noted below.

The One Inch to Ten Miles, or "Ten-Mile" Maps (1:633,600)

The Layered Map of Great Britain

This map has been specially designed for the use of motorists and others who require a detailed map of the whole country, with main roads, towns, and principal villages legibly shown. The map is fully colored--all main roads are shown in a strong red and are easily followed. Relief is indicated by means of contours and layer coloring.

Great Britain is covered by 3 sheets with wide overlaps. A special sheet is published of the whole of Scotland. Each sheet may be purchased separately.

Outline editions showing, respectively, water and contours alone, or physical features only, are also available of this series.

Road Map of Great Britain

This map shows very clearly the Ministry of Transport road classification and road numbers, together with distances between towns and the positions of R. A. C. and A. A. telephone boxes. Relief is indicated by tinted hill shading. Inset plans of the principal towns show in detail the Ministry of Transport's through routes and numbers. The map is available in mounted sections, or in two separate sheets.

Special Air Map

This map covers the whole of Great Britain in 3 sheets. It is fully colored; special information needed for flying is shown by symbols boldly printed in red. Another aviation map is listed with the quarter inch maps, above.

The 1:M or One Inch to 15.782 Miles Maps (1:1,000,000)

Map of the United Kingdom

The map is published in two sheets, 24 1/2 x 34 3/4 each. Sheet 1 shows Scotland and the North of England as far south as Alnwick and includes the Orkney and Shetland Islands. Sheet 2 covers the remainder of Great Britain and Ireland. The hills are shaded in brown and coastal water in blue.

This map is also published in black outline, uncolored.

International Map of the World[1]

Great Britain with the Hebrides, Orkney and Shetland Islands falls on 7 sheets. Six of these are published by the Ordnance Survey; the seventh is published by France.

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[1]See The International 1:1,000,000 Map Report, issued annually by the Secretary, Central Bureau, Ordnance Survey, Southampton; it contains complete lists of the published sheets of the map.

The 1:M or One Inch to 15.782 Miles Maps (1:1,000,000) (Cont.)

Map of Great Britain

Great Britain on this scale is covered in two sheets. Sheet 1 covers Scotland and the north of England; sheet 2 covers the remainder of Great Britain. The system of contours and layer coloring used on these sheets brings out the relief very well, whilst streams, rivers and canals are shown in blue. Roads are shown in red; railroads in black--double and single tracks and narrow gauge railroads are distinguished.

Physical Map of England and Wales

The map is chiefly intended for students of history and geography. It measures 30 x 22 1/2 inches and embraces Edinburgh on the north and the Island of Jersey on the south. Contours are shown at 50, 100, 200, 400, 800, 1,200, and 2,000 feet; and the sheet is orographically colored in tints of red, brown and green. Sea bed contours are shown and emphasized with shades of blue.

Physical Map of Scotland

The map is uniform with the above but with additional contours and colorings for 3,000 and 4,000 feet.

Population Map of Great Britain

The map shows population densities based on the 1931 Census, by making use of 12 shades of tints. The sheet lines and outline are those of the 1:M map in the "International" style described above. The map is in two sheets; sheet 1 covers Scotland, and sheet 2 covers England and Wales.

Miscellaneous Maps

Three-Inch Map of London

The map is published in four sheets which may be obtained separately or mounted together. Every street is shown with its printed name, main traffic routes are emphasized and colored brown. A gazetteer containing every name is also available.

Maps of the Channel Islands: Jersey, Guernsey, and Alderney

On scales of two inches to one mile, three inches to one mile, and six inches to one mile, respectively.

Outline maps of England and Wales

One of these measures 21 1/2 x 29 inches and shows coasts and rivers only; and the other, measuring 12 x 15 inches, shows country names and boundaries.

Historical Period Maps

Roman Britain

A fully colored map on the scale of 1:1,000,000. Supplemented by a brief account of contents, chronological table and an index of place names.

Historical Period Maps (Cont.)

Roman Empire (Scale 1:1,000,000)

Britain in the Dark Ages

A fully colored sheet on the scale of 1:1,000,000, showing names of historical importance during the period 410-871 A.D.

XVII Century England

The map is uniform with the map of Roman Britain

Neolithic Wessex (Scale 1:253,440)

Trent Basin

A map similar to the above.

Celtic Earthworks of Salisbury Plain

Scale, 1:25,000. To be completed in six sheets, of which the first is now available.

## The Large Scale Maps[4]

The term "large-scale" covers all of the Ordnance Survey maps on the scale of six inches to the mile and larger. The maps are specifically on the following scales:

1:10,560 or six inches to the mile
1:2,500 or 25.344 inches to the mile
1:1,250 or 50.688 inches to the mile
1:1,056 or sixty inches to the mile (London)

The first two of these are revised periodically and are the chief national maps. The third is an enlargement of the second.

The question respecting the most useful large-scale maps for Great Britain was much agitated in and out of Parliament during the period from 1840 to 1863, and was finally decided in favor of maps on the six-inch and twenty-five-inch scales. A brief description of these maps is attempted in the following pages.

### The Six-Inch Maps

The first survey on the six-inch scale undertaken in the United Kingdom was made in Ireland; it was completed in 1840.

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[4]On the large-scale maps of Great Britain, see especially the following descriptive catalog, Great Britain. Ordnance Survey. A Description of the Large Scale Maps of Great Britain produced and published by the Ordnance Survey, with specimens, symbol sheet, and diagrams (4th ed., Southampton, 1930); see also, Brigadier H. St. J. L. Winterbotham, The National Plans: The Ten-foot, Five-foot, Twenty-five-inch and Six-inch Scales ([Great Britain. Ordnance Survey. "Professional Papers," No. 16] London, 1934).

The Six-Inch Maps (Cont.)

Approval was given in this same year for the commencement of a six-inch survey of Scotland and the northern counties of England. The first six-inch sheet of England appeared in 1846 and the last sheet of this first edition of the map was published in 1890 and 1891. The map is available for the whole of Great Britain and the adjacent islands. As the area of that country is about 90,000 square miles, and the area covered by each six-inch quarter-sheet is six square miles, it follows that more than fifteen hundred of such quarter sheets are required to cover Great Britain.

Until 1882 the six-inch map sheets were all engraved in full sheets measuring each 36 x 24 inches and covering an area of six by four miles. From that year until 1920 the maps of the English and Welsh counties, with the exception of a few sheets of Lancashire and Yorkshire, were published in quarter-sheets measuring 18 x 12 inches and covering an area of 3 x 2 miles, or 3,840 acres. Publication of the full-sheets was resumed, however, in 1920; and a certain number of revised sheets were also issued of this size. Finally, in April, 1925, it was definitely decided to discontinue the issue of the full-sheets and to publish quarter-sheets only. The full-sheets, with a few exceptions, will accordingly be replaced by quarter-sheets when reprints are required. The same statement holds true for the six-inch maps of Scotland, excepting certain Highland districts for which full-sheets will continue to be issued.

The purposes which the map is intended to serve are many. It is practically indispensable to the civil engineer, the town-planner and builder. It shows every building, road, footpath, waterway and enclosure, and all boundary lines. Latitude and longitude are shown along the sheet margins. Street names in towns are clearly printed, the streets being widened to make this possible. Contour lines are generally indicated at fifty and hundred feet intervals up to a thousand feet above sea level. In some northern counties of England and some southern counties of Scotland contours were instrumentally determined to much greater height. But there are also six-inch maps of certain counties in northern Scotland which are without contour lines.

The map is not wholly beyond criticism. For example, the map has been said to suffer from the disadvantage that it is neither a fully colored topographical map nor a cadastral map,

The Six-Inch Maps (Cont.)

since roads and their boundaries are not shown truly, but widened conventionally, especially in towns. Accurate measurements of areas and properties can not therefore be made on this map, even to the degree of accuracy that one might otherwise expect as proper to the scale.[5] Again, it has been found that the map is on a scale that is unnecessarily large for much of the open country, and which could, with fine drawing of detail, be shown on half the scale, except in built-up areas.

Index Diagrams and Catalogs

The index diagrams of the large scale maps of England and Wales consist of separate map sheets on the scale of four miles to the inch, with each sheet showing a complete county. Each county index diagram shows by red sheet lines the distribution of both the six-inch and the twenty-five-inch map sheets which cover the county. In order to designate any particular quarter sheet of the six-inch map, it is merely necessary to state the name of the county, the Roman numeral of the full-sheet within the county, and the particular symbol of the quarter sheet in question. It should be noted that the indexes to the six-inch and twenty-five-inch maps of Scotland are issued separately in book form. The index diagrams are on the same scale as those of England and Wales, namely four miles to the inch. Separate map catalogs are also issued for the map publications of the Ordnance Survey of Northern Ireland (Belfast) and the Ordnance Survey of the Irish Free State (Dublin). The maps are, of course, of the same nature and on the same scales as those of Great Britain. The title of the descriptive catalog covering the large scale maps of England and Wales is noted at the beginning of this section.

The Twenty-Five-Inch Maps

The twenty-five-inch maps (actually 1:2,500 or 25.344 inches to the statute mile) also cover the whole of Great Britain, except the wild and uncultivated regions, such as the moors of Yorkshire and Scotland. The size of the map sheets on this scale is 38 x 25 1/3 inches. The area covered by each sheet is 1 1/2 square

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[5] "Discussion on Ordnance Survey Maps: . . . . . Meeting of the Society . . . ." Geographical Journal, LXXXVII (April, 1936), 324.

The Twenty-Five-Inch Maps (Cont.)

miles or 960 acres, so that 51,456 such sheets are required to cover Great Britain. It is interesting to note that the scale of the map is such that an acre is represented on the map almost exactly by one square inch. The first survey of England and Wales on this scale was completed in 1890, and that of Scotland in 1895. The first revision of the map was completed in 1905; the second revision, and in some cases the third, is now in progress.

The chief difference between the six-inch map and the twenty-five-inch map is that the latter shows the areas of all enclosures. But, in the strictest sense, this map is not a cadastral map because property boundaries are not actually delineated. However, all the information necessary to determine property boundaries is given, and so are all topographical features, such as roads, railways, rivers, hedges, fences, houses, benchmarks, and spot heights. Ground forms are not shown except in so far as they may be deduced from these heights. The representation of areas on this map is, of course, a most significant feature. Every plot, that is, every area marked by a boundary, has a number stamped on it and its area indicated in acres and decimals, accurately computed to the thousandth part of an acre.

The criticism respecting this map bears chiefly on the mode of its origination. It is a fact, for example, that the map is based on a series of detached county surveys rather than a national survey, because it is projected upon more than forty different meridians.[6] This "county" arrangement has proved a source of much inconvenience and no little extra cost. A departmental committee is presently considering the future policy of the Ordnance Survey, and if it should decide to recommend drastic measures for overtaking the admitted arrears in the revision of this map, an opportunity will be afforded for getting rid of the inconvenience and expense of separate series and of recasting the whole twenty-five-inch survey on national lines on a single projection.

Index Diagrams

The index diagrams of the twenty-five-inch maps are identical with those of the six-inch maps. The area covered by a

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[6] Ibid., p. 309; this criticism was presented by the present Director-General of the Ordnance Survey, Brigadier M. N. MacLeod.

Index Diagrams (Cont.)

twenty-five-inch map sheet is 1 1/2 square miles or 1/16 the area represented on a six-inch map sheet. Therefore, in order to simplify indexing and numbering, each rectangle on the six-inch index diagram corresponding in area to the twenty-four square miles covered by a six-inch map, is subdivided into sixteen rectangles, each of which represents the area covered on one twenty-five-inch map, or 1 1/2 square miles. All that it is necessary to specify in ordering a twenty-five-inch map is the name of the county, the Roman numeral of the six-inch full-sheet, and the Arabic number corresponding to the twenty-five-inch map sheet in question. What was said about map catalogs in connection with the six-inch maps applies also to these larger scale maps.

## THE GEOLOGICAL SURVEY OF GREAT BRITAIN

Geological maps were published in Great Britain even before the establishment of the Ordnance Survey in 1791. One of the most notable examples of these early geological maps is the map of England and Wales and part of Scotland, by William Smith. The creation of the Ordnance Survey gave, however, great impetus to geological mapping, for it provided accurate and detailed topographic base maps on which geological data could readily be superimposed. Indeed, the geological maps as now published by the Geological Survey Department are simply those of the Ordnance Survey with the geological information added. The formal establishment of the Geological Survey Department dates from the year 1835.

### Maps Issued by the Geological Survey Department

The regular map series of the Geological Survey are issued on the following four scales: twenty-five miles to the inch (1:1,584,000), four miles to the inch (1:253,440), one mile to the inch (1:63,360), and one mile to six inches (1:10,560).

Of these, the map on the scale of twenty-five miles to the inch is issued on one sheet, measuring 32 x 23 1/2 inches. The one-fourth-inch map covers the whole of the British Isles in thirty-six sheets. The maps on the one-inch scale are the most important to the geologist; they are the standard maps of the country. Two separate series, one new and one old, are at present issued on this scale. The maps issued on the scale of six inches to the mile are, of course, more detailed than the one-inch maps, but their use is confined to the chief industrial areas, notably the coal fields.

Other Publications of the Geological Survey Department

In addition to the above maps, the Survey also publishes series of: District Memoirs, Economic Memoirs, General Memoirs, and Sheet Memoirs. It likewise issues a series of horizontal sections, and another series of vertical sections illustrative of the geological maps. The horizontal sections are drawn in directions chosen to display the structure of the different districts to best advantage. They are in almost all cases drawn to the true scale of six inches to the mile, and the lines of sections are clearly marked on the maps. The vertical sections are drawn mostly to the scale of forty feet to the inch; they are arranged in the form of columns and give details which it is impossible to include in the horizontal sections on account of the smallness of the scale.

List of Geological Survey Publications

All the numerous publications of the Geological Survey of Great Britain are very adequately covered in the List of Memoirs, Maps, Sections . . . . which is published annually by the Geological Survey of Great Britain and the Museum of Practical Geology and is obtainable from the Ordnance Survey Office, Southampton, and from authorized agents. Supplementary leaflets announcing the latest additions to the Geological Survey's publications are also issued. All these publications, except the maps in manuscript, are obtainable either direct from the Director-General, Ordnance Survey, Southampton, or through the authorized sales agents of H. M. Stationery Office.

THE GEOGRAPHICAL SECTION, GENERAL STAFF, WAR OFFICE

Map Publications

The Geographical Section of the General Staff publishes a very large and varied selection of maps of British territories and of other parts of the world in which Great Britain has special interests or for which it is not likely that maps will be made by the local governments.

In the past the Geographical Section has been largely responsible for drawing and publishing the maps of the Crown Colonies in Tropical Africa. But the Colonial Survey departments have begun to reproduce their own sheets, superseding thereby the G.S.G.S. series. Of these the older sheets are still shown in the

Map Publications (Cont.)

catalog of the G.S.G.S., While for the newer sheets reference must be made to the Index of the Survey Department of the Anglo-Egyptian Sudan (Khartoum), the Gold Coast, Nigeria, Northern Rhodesia, Southern Rhodesia, Sierra Leone, Uganda, and the Union of South Africa.

Other maps of the G.S.G.S. are compilations from route traverses and miscellaneous work and are provisional in character. Others, again, such as the early sheets of the Canadian map, were published by arrangement with the Dominion authorities. As the mapping organizations of the British dominions beyond the seas progress, they naturally tend to take over the map series begun by the G.S.G.S., and set the latter free to devote attention to important general series, such as the International Map of the World, the 1:2,000,000 map of Africa, and the 1:4,000,000 map of Asia.

Catalog of G.S.G.S. Maps

The great variety of the G.S.G.S. maps are adequately covered in its elaborate catalog entitled Catalogue of Maps published by the Geographical Section, General Staff, the War Office. It is amply supplied with indexes, index diagrams, and reference notes, and may be obtained from the publishing agents of the G.S.G.S., one of whom is Edward Stanford, Whitehall House 29--30 Charing Cross, London.

HYDROGRAPHIC DEPARTMENT, GREAT BRITAIN

Admiralty Charts and Other Hydrographic Publications, Catalogue

The number and variety of charts, sailing directions, and book publications issued by the Hydrographic Department is considerable. It is impracticable as well as unnecessary to enumerate them here, for an adequate catalog is available for them. It is entitled Catalogue of Admiralty Charts and other Hydrographic Publications. It is issued from time to time by order of the Lords Commissioners of the Admiralty and is obtainable free from the authorized sales agent, J. D. Potter, 145 Minories, London, E. 1, and from his subagents. Announcements of the most recent additions to the chart publications are made in the Hydrographic Department's Notices to Mariners.

## CHAPTER XV

## OFFICIAL MAP PUBLICATIONS OF GERMANY

### A. Topographical, General, and Special Maps

#### I. The Official Mapping Agencies

The topographic mapping of Germany is distributed among the following mapping agencies:

1. The Reichsamt für Landesaufnahme, Berlin, with its survey branch for Saxony, at Dresden
2. The topographic branch of the Bavarian Land Survey Department, Munich (Bayerisches Landvermessungsamt)
3. The Statistical Land Office of Württemberg, Stuttgart (Württembergisches Statistisches Landesamt)
4. The Department of Public Works of Baden, Karlsruhe (Badische Wasser und Strassenbaudirektion)
5. The Land Survey Department of Hessen, Darmstadt (Hessisches Landvermessungsamt)

It is to be noted that up to recently these various official mapping agencies functioned wholly independently of one another, and that they thus produced not only their own local maps, but also their respective portions of the maps covering Germany as a whole. A first and significant step in the eventual complete coordination of these separate governmental mapping agencies was taken in May, 1935, when the divided responsibility for the production of the maps extending over the entire country was definitely transferred to the exclusive care of the Reichamt für Landesaufnahme,—the official mapping agency of the central government at Berlin. Specifically, the maps thus transferred are the following:

1. The German map (Deutsche Karte), 1:50,000
2. The map of Germany (Reichskarte), 1:100,000
3. The general map of Central Europe (Übersichtskarte), 1:300,000
4. The International Map of the World (Germany's portion), 1:1,000,000

Bavaria and Württemberg will continue for a time to work on their respective portions of the 1:100,000 Reichskarte.

#### II. The Principal Map Publications of Germany

They are:

1. The topographic base map of Germany (Wirtschaftskarte), 1:5,000
2. The plane table sheets (Messtischblätter), 1:25,000

II. The Principal Map Publications of Germany (Cont.)

3. The German map (Deutsche Karte), 1:50,000
4. The map of Germany (General-staff or Reichskarte), 1:100,000
5. The general map of Central Europe (Übersichtskarte), 1:300,000
6. The international map of the world (Germany's portion), 1:1,000,000

and the following maps which are, however, no longer kept up to date:

7. The general topographic map of Germany, 1:200,000
8. The special topographic map of Central Europe (Reymann's map), 1:200,000
9. The general map (Übersichtskarte), 1:800,000
10. The map of western Russia, 1:100,000
11. Various maps of foreign countries: China, Mesopotamia, Syria, etc.

These may be briefly described as follows:

1. The Topographic Base Map of Germany (Wirtschaftskarte), 1:5,000

This is the most recent addition to the official map publications of Germany. Only a few of the 144,000 sheets required to cover the whole of Germany on this scale have been published thus far. However, the map is primarily intended to answer the needs of the industrial and economically most important areas of the country.

The Reichsamt für Landesaufnahme does not, as a rule, take the initiative in the production of these map sheets, but stands ready to prepare them for others against a service charge. The chief contributors to the map are the local survey departments of the large cities, and the provincial survey departments, except those of Bavaria and of Württemberg which do not produce a base map on this scale. The Reichsamt is, however, the recipient of two copies of every sheet of the map compiled anywhere in Germany, and is ready to answer inquiries regarding them.

This is a contour map. The sheets are rectangular in form and measure 40 cm. along the sides. They may be joined to form a larger map. A grid is present. A geographic place-name and a symbol in the upper right hand corner identify each map sheet. The Gauss-Krueger projection is employed.

An index sheet, in two colors, is available on the scale of 1:2,000,000. The sheet is provided with a grid consisting of squares measuring 50 km. along the sides and representing, each, some 625 map sheets. Individual guide sheets are also available for sets of sheets covering particular and limited areas. Occasional lists of new map sheets may be found in the official quarterly publication of the Reichsamt, entitled Mitteilungen des Reichamts für Landesaufnahme, which has been issued since 1925.

II. The Principal Map Publications of Germany (Cont.)

A model map sheet (Musterblatt), and a chart explaining the symbols used on the map, are also available.

2. The Plane Table Sheets (Messtischblätter), 1:25,000

This map is produced locally by the Reichsamt für Landesaufnahme, and by the various provincial survey departments. Work on the map sheets was started in 1876, and has just been completed in so far as the 3065 sheets--the Reichsamt's share--of northern Germany are concerned. Revision of the earliest sheets has already begun, and it is intended to revise each sheet completely every twenty-five years, and partially every five years. These sheets are provided with geographic coordinates, and represent, each, an area of 6' latitude and of 10' longitude. The later sheets are also provided with a grid of Gauss-Krueger coordinates. The projection employed is the polyhedric. The prime meridian is that of Ferro, though the Greenwich meridian is shown on the recently revised sheets.

The Bavarian sheets of the map are based on cadastral plans; those of Württemberg, on the local 1:2,500 map; and those of Baden and Hessen, on their respective 1:5,000 base maps. It may be noted that the Bavarian map sheets are of two types, namely the earlier so-called "positionsblätter" (location or rectangular sheets without geographic coordinates), and the current "gradabteilungsblätter" which are provided with geographic coordinates. The projection of the later sheets is different from that of the earlier ones.

The map sheets have been issued partly in black and partly in three colors. A four-color edition will eventually supersede them.

Three key index maps cover these sheets. The first, issued by the Reichsamt für Landesaufnahme, covers the sheets of Prussia and also those of Saxony and of Hessen. The second is published by the Bavarian topographic office (Bayrisches Topographishes Bureau) of Munich; it covers the Bavarian portion of the map sheets. The third is issued by the statistical land office of Württemberg, and covers that province's share of the sheets. A model map sheet (Musterblatt) and a chart explaining the symbols shown on the map sheets are also available.

A detailed alphabetical list of the map sheets issued by the Reichsamt für Landesaufnahme is included in its handbook, entitled Das Reichsamt für Landesaufnahme und seine Kartenwerke, Berlin, 1931. Current additions to and revisions of the map sheets may be found listed in the Reichsamt's monthly list of new maps (Neuerschienene Karten), and in its bimonthly Mitteilungen. . . . .

Note: A large number of special maps are also issued on the 1:25,000 scale. These are designated as "Sonderkarten," (Special-purpose maps), and may also be found listed in the Reichsamt's handbook. They are likewise briefly listed in the official map catalog issued by the firm of R. Eisenschmidt,

II. The Principal Map Publications of Germany (Cont.)

2. The Plane Table Sheets (Messtischblätter), 1:25,000 (Cont.)

Berlin. It is entitled Amtliche Kartenwerke von Deutschland, Schweiz, Österreich, Ungarn und Dänemark in Verbindung mit dem Reichsamt für Landesaufnahme herausgegeben von. . . . .

Enlargements

Among the more important enlargements made from the 1:25,000 plane table map sheets may be mentioned the following:

1. Map of the environs of Berlin, 1:10,000
2. Map of the environs of Hamburg, 1:10,000
3. Maps of the Rhenish-Westfälian industrial district, 1:10,000

These maps are likewise listed in the above mentioned handbook and catalog.

3. The German Map (Deutsche Karte), 1:50,000

The first, or sample, sheet of this map was issued in 1923. Only a few sheets have been published since. As originally planned, each map sheet was to cover the area of four plane table sheets on the 1:25,000 scale, and the whole of Germany was to be thus covered by approximately 1200 sheets. This plan has now been modified in the sense that future sheets of the map are each to be the equivalent of 7 1/2 plane table sheets. The earlier map sheets, i.e., those made up of four plane table sheets, will be continued in the future as tourist maps. It may also be recalled that the preparation and care of this map will henceforth be the concern of the Reichsamt für Landesaufnahme, only.

The map sheets thus far issued are on the polyhedric projection; they are provided with geographic coordinates, and have contour lines or hachures.

Key index maps are available on request from the Reichsamt für Landesaufnahme, and the respective survey departments of Bavaria and of Württemberg. Recent additions to the map sheets may be found listed in the Reichsamt's monthly map list, and in its bimonthly Mitteilungen. . . . .

4. The Map of Germany (Reichskarte), 1:100,000

This is the first complete and uniform map of the whole of Germany. It consists of 657 sheets of which 529 cover northern Germany, exclusive of Saxony, but inclusive of Hessen, Thuringia, and Baden; Saxony is covered by thirty sheets, Bavaria by eighty, and Württemberg by twenty. The complete edition of the map is available in black only, though a partly completed edition in three colors is also available. Work on this latter edition has however been discontinued since 1929. A certain number of the sheets have appeared in five colors.

The map is drawn on the polyhedric projection. The prime meridian is Ferro, though on the later map sheets the Greenwich meridian has been substituted. Each sheet covers an area of

II. The Principal Map Publications of Germany (Cont.)

4. The Map of Germany (Reichskarte), 1:100,000 (Cont.)

fifteen minutes latitude and of 30 minutes longitude, and comprises the contents of 7 1/2 plane table sheets on the scale of 1:25,000. Relief is shown by hachures only on the edition in black; and by hachures and contours on the edition in colors. A number of the sheets are provided with Gauss-Krueger coordinates.

A key index map covering the whole of Germany is available from the Reichsamt für Landesaufnahme, and a detailed alphabetical list of the individual map sheets is included in its handbook. Recent additions to or revisions of the map sheets may be found listed in the Reichsamt's monthly map list or in its bimonthly Mitteilungen. . . . .

Special Maps Based on the 1:100,000 Sheets of the Reichskarte

Numerous maps of this nature are available. Of these the following may be noted:

a) The "Einheitsblätter," 1:100,000

These maps originated during the late war; they have been continued and extended in numbers since that time. The individual maps consist of a combination of either four sheets of the 1:100,000 Reichskarte to form a full-map sheet (Vollblätter), or of two sheets to form a half-map sheet (Halbblätter).

An index sheet covering these maps for the whole of Germany is issued by the Reichsamt, and a detailed list of all except eight of the 160 "Vollblätter" which cover Germany is included in its handbook.

b) Various other Special Maps, 1:100,000

These are designated as follows:

1. "Kreiskarten," (District maps)
2. "Wanderkarten," (Tourist maps)
3. "Umgebungskarten," (Maps of city suburbs)
4. "Sonderkarten," (Special-purpose maps)

An index map is issued by the Reichsamt für Landesaufnahme for these maps. It is entitled Übersichtsblatt der Kreis, Wander, Umgebungs, and Sonderkarten und ihre Lage zur Karte des Deutschen Reiches, 1:100,000. A detailed alphabetical list of the maps is included in the Reichsamt's handbook. See also the official map catalog issued by R. Eisenschmidt, of Berlin, and the Reichsamt's monthly map list as well as its bimonthly Mitteilungen. . . . .

c) Enlargements from the 1:100,000 Reichskarte

These consist of the following map publications

1. "Kreiskarten," (District maps), 1:50,000

II. The Principal Map Publications of Germany (Cont.)

4. The Map of Germany (Reichskarte), 1:100,000 (Cont.)

c) Enlargements from the 1:100,000 Reichskarte (Cont.)

About twenty such maps have been issued to date for the Rhineland, and one map for Ploen. The maps are in three colors.

2. Map of the "Sauerland," 1:75,000

The map is made up of ten sheets; three colors are used.

These enlargements are listed through 1930 in the Reichsamt's handbook and, up to recent date, in the latest edition of the Eisenschmidt catalog.

5. The General Map of Central Europe (Übersichtskarte), 1:300,000

The map consists of 105 sheets. It makes use of five or six colors, and shows relief by hachures or shading. Seventy sheets have also been issued in black, and some sheets have appeared in provisional form only.

An index diagram for the map is shown on the reverse side of the index sheet issued by the Reichsamt for its special maps on the 1:100,000 scale. A detailed alphabetical list of the map sheets is included in the Reichsamt's handbook. A chart explaining the symbols used on the map is also available.

Derivative Maps

The following map publications are derived from the 1:300,000 map:

1. The Atlas of Germany (Atlas des Deutschen Reiches), 1:300,000

This atlas consists of fifty-two of the general maps of Central Europe; it is available in a black and in a colored edition.

2. German Motor-roads Map (Reichs-Auto Karte), 1:300,000

The map consists of fifty-two folded sheets and employs four colors. The latest edition of the map shows the new German express routes.

An index diagram is available, and a list of the map sheets issued thus far is included in the Eisenschmidt catalog. See also the Reichsamt's monthly map list and its bimonthly Mitteilungen. . . . .

3. Various maps of the German provinces, 1:300,000

For a list of these consult the Eisenschmidt Catalog and the Reichsamt's current map lists.

II. The Principal Map Publications of Germany (Cont.)

6. General Topographic Map of Germany (Topographische Übersichtskarte), 1:200,000

Work on this map was commenced in 1900 and discontinued in 1927, leaving the map incomplete. The map still lacks fourteen sheets out of the total of 196 sheets required for the whole of Germany. The lack of these sheets can, however, be partly made up by corresponding sheets from an older map on this scale. The map is no longer kept up to date except for the map-sheets that are issued as special-purpose maps (Sonderkarten).

Three editions, designated respectively as A, B, and D, are available of the map. Edition A makes use of three colors and is provided with contour lines; edition B is an off-set print of edition A; and edition D shows water and relief only.

An index diagram for the map is shown on the reverse side of the index sheet issued by the Reichsamt for its special maps on the 1:100,000 scale (see above, item (b) under 4). A de-dailed alphabetical list of the map sheets is included in the Reichsamt's handbook. A chart explaining the symbols used on the map is also published.

Special Maps

The maps based on the 1:200,000 topographic map of Germany are:

a) Special-purpose Maps (Sonderkarten), 1:200,000

A detailed list of these is included in the Reichsamt's handbook; a summary list appears in the Eisenschmidt catalog.

b) Enlargements

Map of East-Thuringia and of western Germany, 1:150,000

The map is in three colors. It is listed in the Reichsamt's handbook and in the Eisenschmidt catalog.

7. The Special Topographic Map of Central Europe, 1:200,000 (Reymann's map)

Work on this map originated with Reymann in 1800. The map was transferred to the German government in 1874, and reworked by it for some years; but the map is now no longer revised. No geographic coordinates are shown on the map; relief is indicated by hachures. The map extends geographically to Alençon, in the west, to Minsk in the east, to Aarhus, in the north, and to Trieste, in the south. Each map sheet represents an area of 64.4 by 67.9 kilometers.

An index sheet for the map is obtainable from the Reichsamt für Landesaufnahme by special request only. A chart explaining the symbols used on the map is also issued.

II. The Principal Map Publications of Germany (Cont.)

8. The General Map (Übersichtskarte), 1:800,000

This map originated during the late war. It consists of eighty sheets and extends geographically over: England, France, Belgium, Denmark, southern Sweden, Germany, Switzerland, Italy, Austria, Hungary, Czechoslovakia, the Balkan states, western Russia, Asia Minor, Egypt, Syria, and Mesopotamia. Only the sheets covering Germany have been reworked, and the map is otherwise no longer kept up since 1926. The map is still of some value, however, because it is the only medium small-scale map that presents the major portion of Europe, and the whole of Asia Minor, as a uniform ensemble. The map continues to be of use to air-pilots who employ it to supplement the 1:300,000 scale map of Central Europe. The map will, of course, lose in value as the sheets of the 1:1,000,000 map of the world become available.

The map is in five colors. Relief is indicated by shading, though some of the Russian sheets lack it entirely. The prime meridian is Ferro, with that of Greenwich added on the later revised sheets. Each sheet represents an area of 4' latitude and 4' longitude and measures seventy centimeters from top to bottom but may vary in width between forty-two and sixty centimeters.

An index diagram is shown on the reverse side of the index sheet issued by the Reichsamt for its special maps on the 1:100,000 scale. An alphabetical list of the map sheets is included in the Reichsamt's handbook.

9. Map of Western Russia, 1:100,000

This map also originated during the late war. It consists of 467 sheets, the individual value of which is very uneven. The majority of the sheets are based on the original Russian field maps on the 1:42,000 scale. No revision of any sheet has been made since the war. Relief is shown on some sheets by contours and on others by hachures. The area covered by the map is that of present-day Lithuania, Latvia, a portion of Estonia, and most of Poland.

An index map is available from the Reichsamt by request only, and a detailed list of the map sheets is included in its handbook.

10. The International Map of the World (German's portion), 1:1,000,000

Germany's portion of the world map consists of five sheets designated respectively as: Munich, Vienna, Hamburg, Berlin, and East-Prussia. The maps are in eight colors. A morphologic edition showing water and relief only is also available. All the five sheets have been completed and published.

II. The Principal Map Publications of Germany (Cont.)

11. Various Maps of Extra-European Countries

These are:

a) For China:

Map of Tschili and Shantung, 1:200,000

The map consists of sixty-three colored sheets. An index chart is obtainable on request.

Map of East-China, 1:1,000,000

The map consists of twenty-two colored sheets. An index chart is available on request.

Map of Peking and environs and of Tientsin and environs

The maps are respectively on the scale of 1:25.000; they are in colors.

b) For Palestine:

Map of Mesopotamia and Syria, 1:400,000

Nineteen sheets of the map have appeared thus far. An index map is available on the scale of 1:4,000,000; it is in three colors and is obtainable by purchase only.

Map of Palestine

Thirty-nine sheets of the map have been issued on the scale of 1:50,000 and seven on the scale of 1:25,000. The map is complete and sheets are available as long as the supply lasts.

III. The Principal Map Catalogs and Lists

The principal German map lists and their issuers are as follows:

1. The Reichsamt für Landesaufnahme's map lists

A general catalog is issued by the Landesaufnahme annually for its own map publications. It is obtainable free and is entitled Preisverzeichnis der Karten und verschiedener Druckwerke.

A monthly list is published free by the Landesaufnahme for its recent map additions (Neuerschienene Karten). Finally, the Landesaufnahme includes in its bimonthly Mitteilungen des Reichsamts für Landesaufnahme, systematic lists of not only all the official map publications of Germany but also of many foreign countries. The Mitteilungen have been issued by the Landesaufnahme since 1925.

III. The Principal Map Catalogs and Lists (Cont.)

2. The R. Eisenschmidt Catalogue, Berlin

The firm of R. Eisenschmidt of Berlin is the official distributing agent of the map publications of the Reichsamt für Landesaufnahme. It is also the local distributor of the maps issued by the individual topographic survey departments of the German provinces, and of certain foreign governments. A systematic price-list for the maps from all these official sources is published annually by the firm under the title of Amtliche Kartenwerke von Deutschland, Schweiz, Osterreich, Ungarn und Dänemark in Verbindung mit dem Reichsamt für Landesaufnahme herausgegeben von R. Eisenschmidt.

The catalog is supplemented by three index maps which cover the principal official map publications of Germany. Both, catalog and index maps, are obtainable free.

The official institutions whose maps are listed in the Eisenschmidt catalog are as follows:

a) Of Germany:

1. The Reichsamt für Landesaufnahme, Berlin, and its topographic survey branch office for Saxony, at Dresden
2. The topographic branch of the Bavarian Land Survey Department (Bayrisches Landesvermessungsamt), Munich
3. The Statistical Land Office (Statistisches Landesamt), at Württemberg, Stuttgart
4. The Public Works Department (Wasser und Strassenbaudirektion), of Baden, Karlsruhe
5. The Land Survey Department (Landesvermessungsamt), of Hessen, Darmstadt

b) Of foreign countries:

6. The Austrian Cartographic Institut, Vienna
7. The Swiss Topographic Survey Department (Eidg. Landestopographie), Bern
8. The Royal Hungarian Cartographic Institut, Budapest
9. The Geodetic Institut of Denmark, Copenhagen

3. Local Map Lists

Such lists are issued by the following sources:

a) The topographic branch of the Bavarian Land Survey Office

It is a four-page leaflet and is entitled Verzeichnis der von der topographischen Zweigstelle des B. Landesvermessungsamts herausgegebenen Karten, Plane und Druckshriften (Munich, 1935). The list is reproduced in the Eisenschmidt catalog.

b) The Statistical Land Office of Württemberg

The 1935 catalog comprises seventeen pages and is illustrated with twelve index-diagrams. It also lists geologic maps. Its title is Landkarten und sonstige Druckwerke

III. The Principal Map Catalogs and Lists (Cont.)

b) The Statistical Land Office of Württemberg (Cont.)

des Württembergischen Statistischen Landesamt. The list, except the diagrams and geologic maps, is reproduced in the Eisenschmidt catalog.

c) The Land Survey Office of Hessen

The catalog is in the nature of a folder; it consists primarily of index-diagrams and is entitled Preisverzeichnis der amtlichen Plan und Kartenwerke des Hessischen Landesvermessungsamtes in Darmstadt. A more extensive list, minus the diagrams, is included in the Eisenschmidt catalog.

IV. The Principal Official Key-Index Maps

A. Official Sources of Index Maps

They are:

1. The Reichsamt für Landesaufnahme, Berlin
2. The topographic branch of the Land Survey Department of Bavaria
3. The survey departments of Württemberg, Hessen, Baden, and Saxony, which issue jointly one index map

B. Nature and Scope of the Index Maps

1. The index maps of the Reichsamt für Landesaufnahme

a. Index sheet (Übersicht) to the plane table maps (Messtischblätter), 1:25,000

The sheet shows the distribution of the plane table maps over northern Germany, Saxony, and Hessen. The corresponding distribution of the sheets of the 1:100,000 map of Germany is also shown, and care must be taken to differentiate between these and the 1:25,000 sheets. The eastern half of Germany is displayed on one side of the index sheet, and the western half on the other. For index diagrams showing the distribution of the plane table maps for the remainder of Germany, see the index maps issued singly by Bavaria and jointly by Württemberg and Baden.

B. Index sheet to the map of Germany (Karte des deutschen Reiches), 1:100,000; editions: A, B, C, and D (Einheitsblätter)

The map shows Germany's pre-war boundaries and covers all the 529 sheets that make up the map. The distribution of the "Einheitsblätter," which are available for the whole of Germany, is shown on the reverse side of the index map.

IV. The Principal Official Key-Index Maps (Cont.)

B. Nature and Scope of the Index Maps (Cont.)

1. The index maps of the Reichsamt für Landesaufnahme (Cont.)

b. Index sheet to the map of Germany (Cont.)

1) Index sheet to the "Einheitsblätter" or Edition D of the 1:100,000 map of Germany

These maps are diagrammed on the reverse side of the index map mentioned above, under b.

c. Index sheet to the district, tourist, environs, and special-purpose maps, 1:100,000 (Übersichtsblatt der Kreis, Wander, Umgebungs, and Sonderkarten)

The relation of all these maps to the map sheets of the 1:100,000 map of Germany is shown on one side of the index sheet. On the reverse side are given index diagrams for the following maps:

1) Map of Berlin and environs, 1:50,000
2) General topographic map of Germany, 1:200,000
3) General map of Central Europe, 1:300,000
4) General map of Europe and of Asia Minor, 1:800,000

d. Index diagram to the map of Berlin and environs, 1:50,000

See the index sheet listed under c.

e. Index diagram to the general topographic map of Germany, 1:200,000

See the index sheet listed under c.

f. Index diagram to the general map of Central Europe, 1:300,000

See the index sheet listed under c.

g. Index diagram to the general map of Europe and Asia Minor, 1:800,000

See the index sheet listed under c.

Note: All the above noted index maps are obtainable free; they are usually issued as supplements to the official map catalog published by the firm of R. Eisenschmidt, Berlin, which catalog is also available free of charge.

The index maps listed below are obtainable on special request only.

IV. The Principal Official Key-Index Maps (Cont.)

B. Nature and Scope of the Index Maps (Cont.)

1. The index maps of the Reichsamt für Landesaufnahme (Cont.)

h. Index sheet to the topographic base map of Germany (Topographische Grundkarte), 1:5,000

The sheet is obtainable at the price of 0.50 Mk. It is on the scale of 1:2,000,000 and is provided with a grid each square of which measures fifty kilometers along the sides and represents 625 sheets on the 1:5,000 scale. An inset on the sheet shows an enlargement of the square containing Berlin and environs.

i. Index sheet to the enlarged plane table maps, 1:10,000

The index diagrams shown on the sheet cover the following areas:

1) The industrial areas of western Germany
2) The environs of the city of Berlin
3) The environs of the city of Hamburg

j. Index sheet to the German map (Deutsche Karte), 1:50,000

k. Index sheet to the map of western Russia, 1:100,000

l. Index sheet to the special topographic map of Central Europe, 1:200,000 (Reymann's map)

This sheet has not been revised since the war and shows the frontiers of 1914.

m. Index sheet to the German Auto-road map (Reichs-Auto Karte), 1:300,000

This sheet is on the scale of 1:2,000,000.

n. Index sheet to the International Map of the World, 1:1,000,000

The sheet shows the political boundaries of Germany and the distribution of the five maps which cover the country on 1:1,000,000 scale.

o. Index sheet to the map of Tschili and Shantung, 1:2,000,000

p. Index sheet to the map of East-China, 1:1,000,000

q. Index sheet to the map of Mesopotamia and Syria, 1:4,000,000

The sheet is in three colors and is obtainable at the price of 0.30 Mk.

IV. The Principal Official Key-Index Maps (Cont.)

B. Nature and Scope of the Index Maps (Cont.)

2. Index map of the Bavarian Topographic Bureau, (Übersichten über die Kartenwerke des Bayer. Topographischen Bureau), Munich

The current (1930) index sheet contains diagrams for the following map items:

a. The topographic map of Bavaria and the Palatinate, 1:25,000
b. The topographic atlas of Bavaria, 1:50,000
c. The Bavarian portion of the German map 1:50,000, and of the map of Germany, 1:100,000
d. Special maps of Bavaria on the 1:100,000 scale
e. A map of south-west Germany, a colored contour map of Bavaria, and a road and administrative map, all on the 1:250,000 scale

3. Joint index map of the topographic survey departments of Württemberg, Hessen, Baden and Saxony

Index diagrams are shown for the following map items:

a. For Württemberg:

1) The topographic and geologic special map, 1:25,000
2) Württemberg's portion of the German map, 1:50,000, and of the map of Germany, 1:100,000
3) Maps of city suburbs, 1:50,000, and of the topographic atlas, 1:50,000
4) "Einheitsblätter," 1:100,000, and other special maps on the same scale
5) A highway map, 1:150,000, and an enlarged map of the Suabian "Alb" on the same scale
6) A general topographic map of southwestern Germany, 1:20,000

Note: These diagrams are also included in the catalog issued by the Land Office of Württemberg

b. For Hessen:

The contour map of Hessen, 1:25,000

c. For Baden:

The topographic map, 1:25,000

d. For Saxony:

The plane table maps, 1:25,000

## B. Official Geologic Map Publications

### I. Prussia. Geologische Landesanstalt, Berlin

#### A. Geologic maps

The most important of these are:

1. The geologic map of Prussia and the neighboring provinces, 1:25,000

   This is the principal geologic map of the country. It is still in progress and is being issued in the form of "Lieferungen," i. e., individual sets of map sheets that are identified with particular areas. Each "Lieferung," or set, is accompanied by an "Erleuterungsheft," or explanatory booklet. Some 316 "Lieferungen," comprising 2,162 single maps, had been issued by the end of 1930. Each map sheet with its accompanying "Erleuterungsheft" is obtainable separately.

   Itemized lists of the maps are included in the annual price-list (see below) issued by the Geologische Landesanstalt, and an index sheet for the maps is also available.

2. General geologic map (Übersichtskarte) of Germany, 1:200,000

   Some twenty sheets of the map have been issued for Prussia by the Landesanstalt. The map sheets are numbered the same as the corresponding sheets of the 1:200,000 general topographic map of Germany. The sheets are listed in the Landesanstalt's price-list and on its index map (see below).

3. Map of the exploitable mining areas of Germany, 1:200,000

   The map sheets issued by the Landesanstalt cover Prussia and the adjacent German provinces. They are published in sets or "Lieferungen," of which thirteen had been issued by the end of 1930. An itemized list of the sets is included in the Landesanstalt's price-list, and an index map for the individual map sheets is also available (see below).

4. Numerous single geologic maps on various scales

   Consult the Landesanstalt's price-list for these maps.

Note: All these maps as well as the price-list, index sheet, and other publications issued by the Landesanstalt are obtainable from its distributing office located at 44, Invalidenstrasse, Berlin, N. 4.

#### B. Price-list of publications

der Veröffentlichungen der Preussischen Geologischen Landesanstalt zu Berlin. The price-list includes not only the maps but also the remaining publications of the

I. Prussia. Geologische Landesanstalt, Berlin (Cont.)

B. Price-list of publications (Cont.)

Landesanstalt, such as its tracts ("Abhandlungen"), contributions ("Beitraege"), and reports ("Mitteilungen"), etc. The list is obtainable free.

C. Key-index map

An index map (one sheet) is issued by the Landesanstalt for the following three of its map publications:

1. The geologic map of Prussia and adjacent German provinces, 1:25,000
2. The general geologic map of Germany (Übersichtskarte), 1:200,000
3. The map of the exploitable mining areas of Germany, 1:200,000

One side of the index sheet covers the eastern half of Germany, and the other side the western half. The sheet outlines the whole of Germany but does not show the geological mapping of Bavaria and the Palatinate or of Württemberg and Baden. For the mapping of these provinces, see below. The index sheet is obtainable free from the Landesanstalt.

II. Bavaria. Bayrisches Oberbergamt, Munich

The principal map is:

The geologic map of Bavaria, 1:25,000

The sheets of this map as well as of the remaining map publications of the Oberbergamt are available through its distributing agent, the firm of Piloty & Loehle, Munich. A small price-list, entitled Geologische Werke und Karten, is obtainable from this firm free.

III. Württemberg. Statistisches Landesamt, Stuttgart

The principal geologic map of this province is:

The special geologic map of Württemberg, 1:25,000

The map, when complete, will comprise 184 sheets. About fifty-two sheets have been issued thus far. An index diagram to this map, and a list of the remaining geologic map publications issued by the Landesamt, are included in its map catalog; it is entitled Landkarten und sonstige Druckwerke des Württembergischen Statistischen Landesamts. Maps and catalog are available from the distributing office of the Landesamt, 56 Buchsenstrasse, Stuttgart.

## CHAPTER XVI

## SUMMARIES OF THE OFFICIAL MAP PUBLICATIONS OF (1) AUSTRIA, (2) HUNGARY, (3) NETHERLANDS, AND (4) NORWAY

### (1) OFFICIAL MAP PUBLICATIONS OF AUSTRIA

I. Official Map Source: The Kartographisches Institut, Vienna

II. Official Map Publications:

1. Topographic and General Maps:

Map of Austria, 1:25,000
Map of Austria, 1:50,000
Special map of Austria, 1:75,000
General Staff Map of Central Europe, 1:200,000
General map (Ubersichtskarte) of Central Europe, 1:750,000

2. Special Maps:

Official Automobile map of Austria, 1:200,000 (in 21 sheets)
Various other maps

The five topographic and general maps may be briefly described as follows:

Map of Austria, 1:25,000

This is the base map of Austria. The present edition of the map was started in 1919. It is to consist of about 1500 sheets, 91 of which have thus far been issued. The map is in colors. Sheets of the old map on this scale, in black, are available for all of Austria, except certain areas comprising in all 23 map sheets.

Map of Austria, 1:50,000

The latest edition of this colored map was commenced in 1919. The map shows relief by contour lines representing twenty meters intervals. Numerous spot heights are indicated. Margins are divided in the centesimal system with longitudes from Ferro, and in the sexagesimal system from Greenwich. No grid is present. The average size sheet measures 15 x 20 inches. Only fifteen map sheets have been issued thus far. Professor Arthur R. Hinks pronounces the map "a good clear map except in the mountains, where the cliff-drawing is heavy in color."[1]

Special Map of Austria, 1:75,000

Only seven color sheets have thus far been issued of

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[1]Arthur R. Hinks, Maps and Survey (Cambridge, 1933), p. 89.

II. Official Map Publications: (Cont.)

Special Map of Austria, 1:75,000 (Cont.)

this map which is to succeed the old 1:75,000 map, in 746 sheets, of the Austro-Hungarian Empire, 114 sheets of which cover present Austria. The sheets measure 20 x 14 1/2 inches. Relief is shown by contours and vertical hill-shading. Many spot heights are also indicated. The grid is not carried across the sheet. Longitude is referred to Ferro. About fourteen revised sheets of the old map in black have been issued to date. Most of the map sheets are also published in the form of tourist maps; of these about 90 have appeared so far.

General Staff Map of Central Europe, 1:200,000

This map is the most important official map of Austria next to the special map on the 1:75,000 scale. Approximately 265 color sheets of this map have been issued thus far. It is to replace the General map of Central Europe on the scale of 1:300,000. The sheets measure about 15 x 22 inches and cover a quadrangle one degree long and wide. Relief is mostly shown by contour lines and vertical shading. Longitude is reckoned from Ferro.

General Map (Übersichtskarte) of Central Europe, 1:750,000

Part of the map is on the Bonne projection and part on the Albers projection. The 54 sheets on the Bonne projection were issued during 1883-86; of the sheets on the Albers projection only 12 have thus far been issued. Relief is shown variously by hachures and layer tints. Longitude and latitude are indicated along the margin. Ferro is the prime meridian. Professor Hinks states this to be "a confusing map."

III. Map Lists and Catalogs:

A catalog, supplemented with index charts, completely covers the official maps of Austria. It is entitled Verlags-Verzeichnis des Kartographischen Instituts (Vienna, Krotenthallerg. No. 3). The map list, without the index charts, is also reproduced in the Eisenschmidt catalog mentioned under the German maps, elsewhere. Current additions to, or revisions of the maps are also publicised in the quarterly Mitteilungen des Reichsamts für Landesaufnahme, Berlin.

Austrian maps and catalogs may also be obtained from the following firms: Oskar Andreas, located at Weidlingau, Vienna; G. Freytag & Brendt, 62 Schootenfeldgasse, Vienna; and R. Lechner, 31 Graben, Vienna.

IV. Bibliography:

Josef Muhlberger, "Die Entwicklung der Oesterreichischen Staats-Kartographie," Mitteilungen des Reichsamts für Landesaufnakme, Vol. V, No. 3 (Berlin, 1929-30), pp. 193-213.

Ernst Nischer, Oesterreichische Kartographen, ihr Leben, Lehren und Wirken (Vienna: Oesterreichischer Bundesverlag, 1925). Pp. 192.

## (2) OFFICIAL MAP PUBLICATIONS OF HUNGARY

I. Official Map Source: The Royal Hungarian Cartographic Institute, Budapest

II. Official Map Publications:

The maps are four in number:

Plane table map, 1:25,000
Special map, 1:75,000
General Staff map, 1:200,000
General map (Übersichtskarte), 1:750,000

The maps are survivals of the old Austria-Hungarian empire maps based on the field surveys of the years 1869 to 1887. They are gradually being replaced by newer and improved maps on the same scales. They are briefly described as follows:

Plane Table Map, 1:25,000

Present Hungary is covered by 414 sheets of the map. The prime meridian is Ferro. Each sheet covers 15' of longitude and 7' 30° of latitude and measures 56 x 76 centimeters. The old map sheets are in black only. They are gradually being replaced by revised sheets and by new ones based on the field surveys made since 1927. Approximately 115 of these newer, though mostly revised, sheets have been issued thus far. Some of the sheets are in colors.

Special Map, 1:75,000

Present Hungary is covered by 122 sheets of this map. The surveys underlying the map were made during the years from 1873 to 1889. This was the most important map of the Empire. The old map is in black; each sheet measures 50 x 37 centimeters and covers an area of 30' longitude and 15' latitude. The newer sheets on this scale are based on the 1:25,000 plane table sheets. They are provided with contour lines and make use of five different colors. About twenty-one new sheets of this map have been published thus far, and thirty-two others, based on revised sheets on the 1:75,000 scale, have also appeared.

General Staff Map, 1:2000,000

Present Hungary is covered by 62 sheets of this old Austro-Hungarian general staff map. The surveys for this map were made during the years from 1887 to 1913. The

II. Official Map Publications: (Cont.)

General Staff Map, 1:200,000 (Cont.)

size of each sheet is 38 x 56 inches. The sheets are being revised as far as practicable, and redrawn when necessary. About eleven sheets have thus far been issued in revised form. The map sheets are in colors.

General Map (Übersichtskarte), 1:750,000

The map is a reduction from the old Austro-Hungarian general-staff map on the scale of 1:300,000, dating from 1881 to 1886. Ten sheets of the map cover Hungary. It is on the Bonne projection. Each sheet measures 39 x 33 centimeters; and it is in four colors. The sheets are being reworked and reissued in two editions differing from each other primarily in color and relief. Only one redrawn sheet has been issued thus far, and work on two others is in progress.

Among the important Special Maps of Hungary may be mentioned:

The administrative or political map of Hungary, on the scale of 1:75,000, which is revised currently. Regional maps covering the areas surrounding large cities. These are mostly on the scales of 1:75,000 and 1:200,000; twenty-nine of them have been issued so far. Tourist maps mostly on the scale of 1:50,000. Sport or recreation maps mostly on the scale of 1:25,000. A one-sheet map of the middle and lower Danube, on the scale of 1:600,000, measuring 83 x 86 inches, and in colors. A city map of Budapest on the scale of 1:15,000.

III. Map Lists and Catalogs:

A catalog with index charts is published by the Cartographic Institute under the following title: Magyar Kiralyi Allami Terkepeszet Kiadvanyai (Budapest, 114, II, Olaszfasor 7-9). The maps are also briefly listed in the Eisenschmidt catalog noted elsewhere. Current additions to the official maps of Hungary may be found listed in the quarterly Mitteilungen des Reichsamts für Landesaufnahme, Berlin.

IV. Bibliography:

Aurel Medvay, "Des topographische Kartenwesen Ungarns," Mitteilungen des Reichsamts für Landesaufnahme, Vol. VIII, No. 2 (Berlin, 1932-33), pp. 99-114.

## (3) OFFICIAL MAP PUBLICATIONS OF THE NETHERLANDS

I. Official Map Source: Topographische Dienst, Hague, Prinsessegracht, 15

II. Official Map Publications:

The most important topographic maps of the Netherlands are on the scales of 1:25,000; 1:50,000; and 1:200,000. The maps are briefly described as follows:

Chromo-Topographische Kaart des Rijks, 1:25,000

The map consists of 776 sheets and has been completed. Each sheet measures 25 x 40 inches. The earlier sheets used only two or three colors; the later ones use as many as nine. Contour lines represent 2 1/2 meters intervals. A grid is present. An edition without colors is also available. The map is kept up to date.

Topographische en Militaire Kaart des Rijks, 1:50,000

This map is more familiarly known as the General-Staff map. It consists of 62 half and quarter sheets, measuring respectively 50 x 40 and 25 x 40 centimeters. Contour lines representing five and ten meters intervals are present, and so is a grid. The sheets are available in either a black or a color edition. They are kept up to date.

Chromo-Topographische Kaart des Rijks, 1:200,000

The map is complete in 23 sheets, including 4 sheets covering foreign territories. The sheets measure 25 x 40 centimeters, though a few sheets are only 30 instead of 40 centimeters wide. Contour lines representing ten meters intervals are present. The sheets are available with and without color. They are being kept up to date.

Of the more important Special maps may be mentioned the "Historisch-Statistische Shetskaart," on the scale of 1:100,000 which was published during the years from 1910 to 1922. It is in 30 sheets, each of which measures 50 x 46 centimeters in size. Other significant maps are of the nature of city and regional maps, mostly on the scales of 1:25,000 and 1:50,000, and maps of the provinces on the scale of 1:200,000.

III. Map Lists and Catalogs:

A catalog is published by the Topographische Dienst under the title of Catalogus van Kaarten (Hague, Prinsessegracht 15). This catalog lists not only the topographical maps but also

III. Map Lists and Catalogs: (Cont.)

the geological map publications. For maps of the Netherlands colonies, such as Netherland East India, Borneo, Java, Sumatra, see the Catalogus van Kaartwerken, published by N. V. J. Smulders and Co., Hague.

IV. Bibliography:

P. M. Overluijs, "Die amtlichen Niederländischen topographischen Karten," Mitteilungen des Reichsamts für Landesaufnahme, Vol. VIII, No. 4 (Berlin, 1932-33), pp. 258-84.

## (4) OFFICIAL MAP PUBLICATIONS OF NORWAY

I. Official Map Source: Norges Geografiske Opmaling, Oslo

II. Official Map Publications:

The most important official maps of Norway are:

The topographic map of Norway, 1:100,000
The "Amtskarter (Fylkeskarter)," 1:200,000
The "Generalkart" of South Norway, 1:400,000
The "Landgeneralkart" of Norway, 1:250,000
Special maps (regional and tourist)

A brief description of the maps is as follows:

Topographic Map of Norway, 1:100,000

This is the principal topographic map of the country. It consists of two types of map sheets, designated, respectively, as rektangelkarter and gradteigskarter. The former, as its name implies, is a rectangular map without geographic coordinates; the latter is provided with such coordinates. The sheets with coordinates cover chiefly the area north of parallel 65°; perhaps all of the 155 sheets required of this map have been issued by now. Of the rectangular map about 115 out of a total of 194 sheets have appeared. Many sheets have been revised. Each sheet covers an area of 1° of longitude by 1/3° of latitude. The size of the sheet is 44.8 x 33.6 centimeters. In order to facilitate printing and handling, the sheets covering the area south of parallel 62° have since 1927 been divided into east and west sections. While the early sheets show relief at 100 meters contour intervals, the later ones indicate relief at 30 meters intervals. It should be noted that these later sheets differ considerably in quality from the earliest map sheets which were issued in 1867.

Amtskarter (Fylkeskarter), 1:200,000

This is the oldest topographic base map of Norway--its first map sheets appeared in 1826. The map shows the administrative or political divisions of the country. About thirty map sheets, covering sixteen districts, have thus far been published. Relief is shown by shading, although some of the newer sheets have contour lines. The prime meridian is Ferro. Coordinates are given in Norwegian foot measure (31.374 centimeters to 1 foot). Spot heights have been added on the later sheets. Many sheets have been revised.

II. Official Map Publications: (Cont.)

Generalkart of South Norway, 1:400,000

This map is complete in 18 sheets. It makes use of four colors. The first map sheet appeared in 1868, and the last in 1910. Relief is shown by contour lines representing intervals of 500 Norwegian feet. Shading is also applied.

Landgeneralkart of Norway, 1:250,000

This is a new map in 9 colors. Relief is shown by contour lines representing 50 meters intervals. The map was started in 1914. It is to comprise 54 sheets. The northern sheets cover an area of one degree of latitude by three degrees of longitude; the southern sheets cover only two degrees of longitude. Sixteen sheets of the map had appeared in 1934.

Of the Special maps the following are noteworthy: The so-called "Rodane" map on the scale of 1:100,000, which covers the entire Rondane mountain region. The map is on the Gauss-Krueger projection and makes use of 11 colors. It measures 46.2 x 35.2 centimeters. It is the result of recent surveys. Less elaborate are the maps covering the regions surrounding the large cities. These are mostly on the scales of 1:25,000 and 1:50,000 and make use of 5 colors Contour lines representing 10 meters contour intervals are present. The sixth sheet of the 8-sheet map showing the surroundings of the city of Bergen was issued in 1934.

III. Map Lists and Catalogs:

All the maps issued by the Norges Geografiske Opmaling are listed in its periodically revised Katalog over Landkarter, which is obtainable from the director of the Survey and from authorized agents. Current additions to the maps may be noted in the quarterly Mitteilungen des Reichsamts für Landesaufnahme, Berlin. For the sea-charts of Norway, see the Katalog over Sjokarter og Farvannsbeskrivelser, which is available from the Norges Sjokartvert, Oslo. The catalog is provided with index maps.

IV. Bibliography:

Major J. K. S. Klingenberg, "Die amtlichen topographischen Kartenwerke Norwegens und ihre geodätische Grundlage," Mitteilungen des Reichsamts für Landesaufnahme, Vol. VII, No. 4 (Berlin, 1931-32), pp. 232-41.

## CHAPTER XVII

## CLASSIFICATION, CATALOGING, AND CARE OF MAPS

The ultimate aim in classifying a map collection is to assign to each map therein a place which, from the point of view of practical utility, is the most logical one within the map file as a whole. More specifically, the aim is to arrange or group the map collection in such a way as to place naturally related maps, and map groups, in convenient proximity.

Of prime importance in map classification is the proper consideration of the following map characteristics: area; subject; date; author, compiler, engraver, or publisher. Because the concept of geographical or areal distribution is the most distinctive and obvious characteristic of all maps, differentiation of maps and map groups by area has come to be the first and invariable step in map classification. Indeed many map libraries go no further and content themselves with a purely regional arrangement of their map file. However, it is believed that most of the important map libraries classify their collections not only by area, but also more or less elaborately by subject.

Thoroughly detailed and systematic classification by subject as well as area is still very much the exception. One reason for this is no doubt to be found in the prerequisite formulation of a classified subject index, and suitable map notation scheme. The task of working out such an index for a large, diversified, and expanding map collection is not an easy one. It would no doubt be measurably less formidable if, as with books, a standard subject classification were available for map collections in general. But such a classification still remains one of the major desiderata of map library economy. Its formulation is doubtlessly beyond the competence of any single institution. Its solution might perhaps be facilitated by the major grouping of map libraries on the basis of scope, content, and purpose, and the devising, for each group, of the subject classification most suitable to its particular needs. In the meantime, individual map libraries might find it profitable to work out a map classification of their own, and apply it at least

to those sections of their collection which are particularly rich and diversified in content, such as the assemblies of local maps, for example. A merely tentative outline of a subject classification scheme for maps is submitted in Appendix I. A brief description of existing map classification practices may facilitate an understanding of the present state of this problem.

A striking example of a map classification based primarily on the obvious criteria of area division, supplemented by alphabetical and chronological subdivision, is afforded by the map collection of the Library of Congress. Here, beginning with the world and the hemispheres, each continent is divided into geographical and political entities, and under each of these units provision is made for: (1) special maps, (2) maps of political subdivisions, (3) maps of urban areas, and (4) maps of geographic or economic regions.[1] Under the main heading of "special maps," the map division of the Library of Congress groups maps and atlases relating to special subjects, such as: geology, history, railroads, and treaties. The order of the sub-arrangements is in every instance alphabetical and chronological. No detailed subject classification or grouping is attempted with this vast and rapidly growing map collection, and no classified subject index and notation scheme have been formulated. An outline of the major area divisions employed by the library in the arrangement of its map file is reproduced in Appendix II.

Another large and diversified map collection which is arranged on a strictly regional basis, is that of the American Geographical Society.[2] Here, general maps of the world are followed by maps of the major continental divisions, and political and geographical subdivisions. Within each geographical unit, the maps are arranged chronologically.

While most of the Society's large sets of maps and their key index charts are shelved in their proper regional location, an exception is made for certain map series which are filed as a

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[1]See U.S. Library of Congress, Division of Maps, Notes on the Cataloging, Care, and Classification of Maps and Atlases including a list of publications compiled in the division of maps. Revised edition by Philip Lee Phillips (Washington: Government Printing Office, 1921). Pp. 21.

[2]The facts concerning the American Geographical Society's system of map classification and cataloging have been kindly supplied by the Society's map librarian, Elizabeth T. Platt.

unit instead of being scattered through the geographically arranged map file. Nautical charts, for example, are of this nature. These charts are shelved together in the numerical order of their series numbers, and are checked and conveniently located by means of the elaborate book-catalogs with index charts, which the government hydrographic services specially issue for these charts. Similarly shelved are the map sheets on the scale of about one inch to the mile, which form part of the topographical atlas of the United States. These sheets are arranged alphabetically by states, and by quadrangles within the states.

Atlases also receive special treatment. Modern atlases are grouped by classes. Older atlas material is not classified either by subject or date, and is not kept in the atlas room. It is, however, adequately cataloged and made easily available for consultation.

Partly because the arrangement of the main map file does not afford the advantages of a detailed subject classification, the American Geographical Society has devised for the needs of its research personnel a separate "Research Catalog," which is classified by subject as well as area. This catalog is briefly described in the section devoted to cataloging practices.

A somewhat different regional classification of the map file has been devised for the Grosvenor Library, at Buffalo.[3] Here the order of the map collections is not directly determined by major and minor geographical divisions, arranged alphabetically, but is based on ten index charts, representing, respectively: Canada; the United States; Mexico; Central America and the West Indies; South America; Europe; Asia; Africa; Australia, and the Islands of the Pacific; the North Polar Regions; and the South Polar Regions. The outline of each map in the file is sketched in its proper place on its respective index chart and both, map and outline, are marked with an identifying number. These numbers run consecutively, beginning with number one, on each index chart. These charts serve, therefore, as guides as well as checklists to the contents and order of the map file.

The map notation which has been devised for this collection consists of the name of the index chart; the number of the map with respect to its outline on that chart; the number of the

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[3]See Rudolph Armbruester, "Maps, Their Care and Cataloging," Library Journal, XLVII (October 1, 1922), 830.

map-case drawer in which the map is filed; and its place-number in that drawer. A typical notation of a map relating to Asia is as follows: "Asia, No. 14. Map Case Drawer No. 5. Sheet No. 3." Although this arrangement does assign to each map a definite place in the map file, it does not include groupings of the maps by subject, so that for subject sequences recourse must be had to the map catalog.

A good example of the partial application of an area-subject classification is afforded by the map collection of the Virginia State Library, Richmond.[4] Here, the maps relating to Virginia are classified regionally in the sequence of the place numbers: 931-999 (with the first 9 omitted), of the history section in the Dewey decimal classification. Under each region the maps are first grouped alphabetically by subject, and then by the date of the situation depicted. The map notation consists of the Dewey place number; a descriptive adjective or noun denoting the subject group under which the map is classified, and the date of the map. For example, a railroad map of Virginia, dating from 1880, would receive the following notation: "755/Railroad/1880"; and a geological map of Henrico County, Virginia, dating from 1907, would be marked: "755.43/Geological/1907"; this map would follow in the map file all the general and agricultural maps relating to that county, but precede all historical and road maps. With the exception of the Dewey place number this notation is thus entirely descriptive and self-explanatory. The subject classification of the map file is, however, only partly realized, because the group arrangement of the maps is alphabetical. Here, too, the catalog must remain the main guide to the map collection whenever related subject sequences have to be consulted.

Another noteworthy and primarily regional arrangement of the map collection is in use in the map library of the Military Intelligence Division of the War Department, General Staff, Washington, D.C. This system of map classification was especially worked out for the purposes of this library by Arch. B. Williams,* the cartographic engineer of the Geographic Branch of the General

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[4] See Wilmer L. Hall, "A Classification for Maps," loc. cit., L (March 15, 1925), 257-59.

*See, however, the postscript at the end of the chapter.

Staff, with whose name it is identified.[5] The primary basis of the classification is geographical, the world being divided into major and minor regions, and subdivided, alphabetically, by countries, states, provinces, etc. The novelty of the system consists in the grouping of the maps in each geographical division by: (1) atlases; (2) books; (3) map sets; (4) "general" maps, i.e., maps covering a whole country; and (5) "part" maps, i.e., maps showing only part of a country or geographical unit. The map notation devised for this classification is wholly descriptive and self-explanatory. For example, the class number of a map covering all of Turkey would have the form: "G-127/Turkey." The letter "G" denotes that the map is classed in the group of "general" maps, that is, maps showing the whole of the geographical unit; the number simply stands for the place of the map within its group file. A map covering only a part of a geographical division would be given a class number including a letter descriptive of this fact. For example, a map showing only part of Nicaragua would receive the following form of notation: "P-147/Nicaragua."

Although this system of classification assigns to each map a definite place in the map file, the criteria which determine its location are not those of map content or subject matter. It is, therefore, practically necessary to have recourse to the map catalog for the tracing of every single map in case one wishes to consult a group of maps relating to a given subject. The correspondingly elaborate map catalog which has been devised for this map file is described further on.

Perhaps the only attempt made thus far to classify a map collection not only with respect to area, but especially with regard to subject classes, is represented by the map library of the Department of State, Washington, D.C.[6] The avowed aim here was to provide for each map a definite place in the map file in relation to every other map, and to group related maps in a convenient and continuous sequence. The principal map data which served as the

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[5] The Williams System of Classification, Cataloguing, Indexing, Filing, and Care of Maps as adopted for the General Staff Map Collection, Washington (2d ed., Copyright, 1930. By Lt. Col. J. P. Terrell, Chief, Geographic Branch, Military Intelligence Division, War Department, General Staff).

[6] See U.S. Department of State, Library, Classification and Cataloging of Maps and Atlases [by] S. W. Boggs, geographer, Department of State, Dorothy C. Lewis, map librarian . . . . (Washington, 1932) [Mimeographed].

basis for this detailed classification were those of: area; subject; date; and, if necessary for complete map differentiation, also author and title. The classified tabular outlines of area and subject headings, and the system of class notation which had to be specially worked out for this arrangement, are included in the library's mimeographed handbook on map classification. The most typical form of its class number is made up of a sequence of three or more numerals to denote area, and a combination of one or two letters to indicate map content or subject matter. The date of the situation portrayed on the map is added to these items whenever possible. In cases where the complete differentiation of a map requires further distinctions, additional symbols are added for author and title. For maps of a special form, such as roller maps, relief maps, atlases, and globes, which usually require special shelving, an appropriate letter indicating location is prefixed to the call number. An example of the form of a typical class notation is the following: "570eb/1911,"--where the number represents the key to the area of the map as listed in the tabular area index; and the letters denote the content of the map as shown under these symbols in the corresponding classified subject index. A call number differentiating a map not only with respect to area, subject, and date, but also by author and title, would add the Cutter number and also a title letter; it would have the following form: "570a/1931/H35p."

The obvious advantages of such a closely classified map file are substantially analogous to those offered by the classified book-shelf. That is, the maps forming a given class or subject group may be directly located in the map file without the necessity of detailed recourse to the map catalog. But the great problem underlying such an arrangement is the prerequisite necessity of working out a detailed subject classification and notation system--as was pointed out previously.

## The Map Catalog

If the utility of the classified map file is more immediately of benefit to the map custodian who must have for each map a definite and readily traceable place, the map catalog is directly serviceable not only to the map librarian, but to the whole map consulting public. It occupies the position of a master guide or key, a checklist "raisonnée," to the scattered contents of the map

file. What may appear accidental and purely conventional in the order of the map file, must have its compensatory counterpart in the logical, classified arrangement of the map catalog. It is the master key to the map file inasmuch as it affords, as a rule, more than one approach to the presence and location of each map in the file. For example, separate catalog entries are almost invariably made for each map with respect to: area, subject, and author. Headings for scale and date are also quite frequent.

With regard to the form and content of the catalog card, the practice is to make a single, complete record of each map in the form of a "unit" or master card, and to reproduce from it all the multiple entries desired for the map. The unit card is therefore the exact model for all the entries appearing for a map in the catalog, except that it has a blank space at the top for the insertion of individual subject headings. The unit card itself is not usually added to the map catalog.

Although the form of the entry card may differ from one map library to another, its contents are fairly uniformly concerned with the following characteristic map items: title; author; imprint; collation; scale; projection, prime meridian, colors, and relief. Descriptive notes and cross references are nearly always included. Sources of maps located in books and periodicals are invariably indicated. Inset maps are accorded the same treatment and, if important enough, are cataloged separately. A few examples of individual map cataloging practices may be noted by way of illustration.

At the Library of Congress maps and atlases are cataloged by author and subject.[7] The subject entries include not only such names as those of: country, state, rivers, and mountains, but also such descriptive headings as: geology, hydrography, roads, and history, etc. Some of these headings, it may be recalled, correspond to similar groupings in the map file. An exception is made to the general filing order of geographical titles in the case of city names. For example, the name of Rio Janeiro is not listed under South America and Brazil, but under Rio Janeiro. Maps in important atlases, especially those relating to America, are cataloged separately. City plans and all maps showing noteworthy features are also singled out for separate entry. A special section is, moreover, reserved for a continuous atlas file.

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[7] Cp. U.S. Library of Congress, Notes . . . ., op. cit., pp. 7-14.

The American Geographical Society maintains two separate map catalogs. One of these is the general catalog containing a complete record of all the maps in the library; the other is a "Research Catalog," made up of selected and completely classified map titles. The general catalog is arranged by area, author, and title or subject headings--the latter grouped by classes. Under each subject heading the entries are filed chronologically. An important feature of the catalog is the inclusion of map titles contained in books and periodicals. It has been estimated that about three-fourths of the entries in the catalog refer to maps of this nature. For the ready distinction of map series in process of publication, the library makes use of red entry cards.

The separate "Research Catalog" which the American Geographical Society maintains for the special needs of its research workers, is divided into two sections. The first contains classified map entries selected on the basis of distinguishing geographical characteristics; the second has entries chosen with respect to cartographical technique. The special notation scheme of numbers and letters devised for this catalog readily facilitates the filing together of map entries which, if arranged by alphabet, would be widely scattered about the file. For example, by running through the cards marked 27b--the class number standing for Spain--one is sure to find there all the entries dealing with Spain, and without having to search separately under such names as Andalucia, Madrid, or Zaragoza. For this catalog blue cards are used.

Another interesting classified map catalog is that of the map library of the Military Intelligence Division, Washington, D.C. Its arrangement is quite systematic and detailed.[8] Each geographical unit has its map material divided into major classes, as follows: atlases; books; map sets; general maps (i.e., maps covering a whole country); and maps showing a part only of a country. Atlases and books are filed chronologically; but under each of the remaining divisions map entries are systematically grouped by: scale, subject classes (arranged alphabetically), and important geographical names (also filed alphabetically).

The special entry card which has been designed for this catalog is a form card measuring 4 x 6 inches, the surface of

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[8]Cp. The Williams System of Classification . . . ., op.cit.

which is ruled into sections allowing the insertion of a complete map record. Since this library maintains not only a map catalog, but also several other map record files (e.g., source file; author file; "geographic file"; daily record file, etc.), the number of entry cards required for a given map may run fairly high. However, all of these cards are completely reproduced by a mechanical process from the imprint of a single unit or master card, except for the addition of the individual subject headings. Different color schemes are employed for the differentiation of the cards in the various files.

In the case of sets of maps, an independent check is made by means of their respective index charts. Moreover, a master index chart, revealing at a glance for what areas within a geographical division map sets are available in the file, is constantly kept up to date. The file numbers of the individual map sets are inscribed on these charts.

Because the Williams system of map classification and cataloging is perhaps the only system of this nature for which a complete outline has been published in convenient booklet form,[9] it may be worth while to examine it a little closer. First of all it must be stated that the Williams system does provide a single and definite place for each map in the map file, although the file is without subject arrangement; that it employs a scheme of map notation which is entirely descriptive and self-explanatory; that it makes use of a special entry card permitting the systematic and complete recording of each map; and that, finally, it crowns this all by a map catalog which is classified throughout.

If it is conceded, however, that the technical utility of a map collection is ultimately determined not by the map catalog, no matter how elaborate and useful by itself, but by the facility with which groups of topically related maps may be located without much necessity for detailed consultation of the map catalog, then the Williams system is perhaps not so "adaptable for universal standardization of all map collections," as stated in the preface of its booklet. In other words, it is believed that the elaboration of a classified map catalog cannot wholly compensate for the absence of a subject arrangement from the map file--at least not in the case of large and diversified map collections. Indeed,

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[9]Note: A second edition of the booklet was issued in 1930. See the full entry under footnote 5.

with such collections it would seem a practical necessity of having the map file arranged so as to permit the independent expansion of individual subject groups. Under the Williams system all single maps are added to their respective geographical sections in the file, in a wholly numerical, or accession, sequence, that is, without regard to subject matter. However well such a system may work with map collections primarily geographical in content and purpose, it cannot be expected to be equally serviceable with collections containing not only general and historical maps, but also sizeable portions of that great and rapidly growing variety of special-purpose maps to which, for example, the detailed and manifold surveying activities of national, state, and city planning bodies are so largely contributing. With these collections, the application of a suitably classified subject arrangement to the map file would seem to be indispensable. As noted previously, an example of a completely classified map file is furnished by the map library of the Department of State, Washington, D.C.

A rather novel note in map cataloging practices is sounded by the library of the Department of State. Here the professed object is to make the map catalog cards as nearly as possible uniform with the book entry cards of the Library of Congress--at least so with respect to subject and area headings, order of information, size, and general typographical appearance. "This," it is claimed, "should make it possible to consolidate the map catalog with the book catalog, enabling the consultant at once to find both textual material and maps bearing on a subject in which he may be interested."[10]

The point which may surprise is the proposal to consolidate the map catalog with the book catalog. Now, it could hardly be contended that such a merger would, in general, be preferable to a separately maintained map catalog. In fact, it appears that the conditions favorable to such a consolidation are exceptional, indeed. It is readily enough conceded that the arrangement is an ideal one in connection with a book catalog largely made up of entries relating to geographical distribution phenomena and cartography, so that book and map entries are mutually supplementary. But with the average map collection a separate map catalog will

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[10] U.S. Department of State, Library, Classification and Cataloging . . . ., op. cit., p. 3.

prove by far the most advantageous. Such a catalog leaves, moreover, full discretion to add specific map entries to the book catalog whenever it is desirable.

The form of "unit" or master card employed with the map collection of the Department of State, closely resembles the familiar pattern of the Library of Congress cards. Only one such master entry card is made for each map; all the other entries are direct reproductions from it, except for the individual subject headings which are added afterwards. One of the copies is designated as the main-entry card. It usually bears the heading under which the map has been classified and indexed. A record of all the different entries made for a map is noted on the back of this card, while a reference to the main entry is added near the bottom of the various subject entries. The unit card itself is not usually added to the catalog.

If this brief analysis of a few typical map cataloging systems revealed sizeable differences in the make-up of map catalogs, it also disclosed the presence of considerable agreement in cataloging aims and practices. The reasons for this relative accord are largely grounded in the natural similarity of map problems presented by map collections in general, and in the fact that book cataloging technique is, on the whole, applicable to maps.

## Some Map Cataloging Problems

There are, however, some cataloging problems which are more or less peculiar and troublesome in the case of maps. A few of these may be noted rapidly.[11] They may conveniently be expressed in the form of questions, as follows. In whose name is a map to be recorded: in the name of the publisher, the engraver, or the cartographer? How is the scale of the map to be computed where none is indicated? How is the size of the map to be measured, with or without the inclusion of margin and overlap? Again, in what sequence are these measurements to be recorded? Should the figure denoting width always precede that of height? And is it necessary or only desirable that the size of a map be stated in addition to its scale, or is it sufficient to indicate the scale alone? The answers given to these questions by different map libraries are not always in accord, although it should not be

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[11]See also Henry A. Sharp, "The Cataloguing and Description of Maps: Some Problems," Library World, XVIII (1916), 256-61.

difficult to bring about the desired degree of uniformity in the underlying cataloging practices.

Rather different, and often more intricate, is the problem of dating an undated old map. However, in the case of early printed maps, it is frequently possible to establish an approximate date by examining one or more of the following items: watermark;[12] physical appearance and structure of the paper; style of letterpress; printing; nature and amount of ornamentation; prime meridian; changes in the spelling of place names, and similar internal evidence. A rough approximation of the date may also be obtained on the basis of the dates corresponding to the author's flourishing years. A select list of possible bibliographical aids in map cataloging is appended below.[13]

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[12] See Edward Heawood, "The Use of Watermarks in Dating Old Maps and Documents," Geographical Journal, LXIII (May, 1924), 391-411.

[13] (A) Aids in the Cataloging of Historical Maps and Atlases. In addition to the bibliographical works cited previously under such names as: Philip Lee Phillips, Woodbury Lowery, Justin Winsor, Henry Harrisse, and Thomas Chubb, the following items may prove helpful in the cataloging of historical maps: Herbert George Fordham, Studies in Carto-Bibliography . . . . (Oxford, 1914); this contains a chapter on the cataloging of such maps. Walter Ruge, "Aelteres kartographisches Material in deutschen Biblioteken," Gesellschaft der Wissenschaften zu Goettingen, Nachrichten . . . . Philologisch-Historische Klasse, pp. 1-69 (1904); pp. 1-39 (1906); pp. 35-166 (1911); Beiheft, 1916; this is a most valuable descriptive list covering most of the historical map material in German libraries. Henry Harrisse, "Cartographia Americana Vetustissima," forms Part Third of his Discovery of North America (London and Paris, 1892). British Museum, Catalogue of the Printed Maps, Plans, and Charts in the British Museum (2 vols.; London, 1885). The valuable descriptive catalog, entitled Exposition de la cartographie Belge aux XVI$^{e}$, XVII$^{e}$, et XVIII$^{e}$ siècles ... (Antwerp, 1926); it contains a scholarly introductory sketch of the cartography in the Low Countries, by F. van Ortroy. John E. Shearer, Old Maps and Map Makers of Scotland (Stirling, 1905). Vincenz Haardt von Hartenthurn, Kartographie der Balkan-Halbinsel im XIX Jahrhundert (Vienna, 1903). Clara A. Smith, List of Manuscript Maps in the Edward E. Ayer Collection ([Multigraphed] Chicago: Newberry Library, 1927). Atlases in Libraries of Chicago ([Planographed] Chicago: University of Chicago Libraries, 1936).

(B) Modern Maps and Atlases. In addition to the modern map lists and bibliographies cited elsewhere, the following items may be of help in map cataloging: American Geographical Society, Catalogue of Maps of Hispanic America . . . . (4 vols.; New York: American Geographical Society, [1933]); this is an invaluable standard map list covering the Hispano-American countries; it also includes maps published in books and periodicals. Alva Curtis Wilgus, Maps relating to Latin America in books and periodicals

## The Care of Maps

The most satisfactory method of storing maps, plans and charts is by use of the familiar horizontal filing cases, preferably of metal, provided with drawers of suitable length and breadth, and of shallow depth. In these drawers the maps are usually placed in folders of heavy manila paper--both drawers and folders being marked with their respective contents. There is also on the market a vertical Art Metal filing unit (Globe and Wernicke) wherein sheet maps are suspended from a metal frame by means of cello clips. The whole is enclosed in a metal cabinet.

An interesting exception to its practice of horizontal map filing is made by the Grosvernor Library in connection with the U.S. Geological Survey maps forming part of the topographical atlas of the United States. These map sheets with their index charts the library combines in loose-leaf manila books. It accords the same treatment to old maps, thus giving to them the form of classified and chronologically arranged historical atlases.

Roller maps are usually stored most conveniently in large, vertical, wooden boxes, divided into squares. Atlases, if of moderate size, may be shelved in an upright position. For large and heavy atlases the roller shelf unit of Art Metal seems to offer the best solution.

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([Mimeographed] Washington, 1933). "Catalog of Published Bibliographies in Geology, 1896-1920," National Research Council, Bulletin No. 36 (October, 1923). "List of Manuscript Bibliographies in Geology and Geography," National Research Council, Reprint and Circular, Ser. No. 27 (1922).

(C) Periodical Literature Aids. It may be convenient to recall here rapidly the names of the periodical publications which may prove especially helpful in the tracing of modern map titles. They are: Bibliographie géographique internationale. Geographical Journal, with its valuable bibliographical supplements. Geographical Review. Geographisches Jahrbuch. Map List No. 53 (U.S.). Mitteilungen des Reichsamts für Landesaufnahme. Monthly Catalogue, United States Public Documents. Monthly List of State Publications (U.S.). Petermanns Mitteilungen. Scottish Geographical Magazine.

To these may be added: Isis, an international review devoted to history of science and civilization, and published at Brussels since 1912; and, U.S. Copyright Office, Catalog of Copyright Entries, which is published in monthly issues, and in several different sections, by the Government Printing Office, at Washington; the section marked: "Part I, Group 2," contains a list (marked Class F) of copyrighted maps as issued in the United States each month. Finally, the periodical publications published under the auspices of the state historical societies may also be consulted with profit, especially in connection with historical maps and atlases.

Finally, old and rare maps and all other maps that are frequently consulted, should be mounted on muslin.

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POSTSCRIPT.--Since this chapter was completed--but unfortunately too late to permit its revision--there have been received from Mr. S. W. Boggs and Mr. Arch. B. Williams a number of additions to and corrections of the sections in the chapter devoted respectively to their map classification systems. A brief résumé of this material follows.

Mr. Boggs' letter with corrections and suggested revisions was received on November 3, last. Here it is made clear, first of all, that the manual on map classification of which Mr. Boggs and Mrs. Lewis are the joint authors, was wholly prepared in the Office of the Geographer, Department of State, and has no direct relation to the library of that Department. More specific is the correction of the erroneous assumption made on page 291 with respect to Mr. Boggs' advocacy of a consolidated map and book catalog. The error is due to a mistaken interpretation of the quotation cited on that page, for Mr. Boggs explains that he does not now and has not at any time favored such a consolidation. Mr. Boggs also discloses the latest changes he has made in the preparation of his map catalog cards. Briefly, a stencil is made for each map title from which, in turn, the desired number of identical cards for the catalog (i.e., "unit cards") may be run off on an Elliott Addressing Machine. To these unit cards are then added by typewriter the call number of the map and, to each card individually, one of the headings listed as tracings (in the same way as is done with the Library of Congress unit cards). The main entry is invariably made under the name of the geographical area (or geographical area and subject) which corresponds to the classification of the map. It may finally be noted that Mr. Boggs and Mrs. Lewis are actively working on a new and revised edition of their manual, although no date has as yet been set for its publication.

Mr. Williams' letter detailing the latest and very significant changes made in his classification system, is dated November 23, 1936. From it it is learned that the Williams system has now added a classified subject arrangement to the map file. The description and critical appraisal given of this system in the preceding chapter is therefore no longer valid in this respect. In Mr. Williams' words, the new "numerical cartographic subject classification" consists "of a group of thirty main subjects, which means that each main cartographic subject is represented by an arbitrarily assigned Arabic numeral as shown on the 'General Index of The Williams System, Numerical Cartographic Subject Classification.'" This numerical cartographic classification chart, it is further explained, "is the ONLY key chart used in any part of the whole Williams' System, and as it contains only thirty main subject numbers most of them can be readily memorized." Unfortunately, no opportunity has as yet been afforded to see and study this all-important subject classification chart. The addition of the subject classification has of course made necessary a corresponding change in the map notation or call number, so that this number is no longer quite as descriptive and self-explanatory as formerly. However, a more definitive description and appraisal of the revised Williams system of map classification must wait until a copy of the subject classification chart has been made available.

# A P P E N D I X  I

## TENTATIVE MAP CLASSIFICATION OUTLINE BY SUBJECT

GENERAL AND BASE MAPS

Topographical maps
Cadastral maps
Tourist and road maps
Comparative area maps

Base maps
Outline maps
Census tract maps
Aerial survey maps
Pictorial maps
Orientation maps
World maps

PHYSICAL GEOGRAPHY

I. GEOLOGY

Maps showing
- Outcrop formations
- Folding, faulting, tectonics
- Volcanoes and vulcanology
- Seismology and earthquakes
- Glacial geology
- Paleontology and paleography

II. PHYSIOGRAPHY AND RELIEF

Physiographic and block diagrams
Relief maps (contours, hachures, tints, etc.)
Relief models (three dimensional)

Maps showing
- Physiographic regions:
  - Continents
  - Plains
  - Plateaus
  - Mountains
    - Hills
    - Valleys
    - Lakes
    - Scarps, etc.

II. PHYSIOGRAPHY AND RELIEF (Cont.)

Maps showing
- Natural drainage basins (major and minor catchment areas)

III. OCEANS AND OCEANOGRAPHY

Maps and charts showing
- Navigable tidal waters
- Tides and co-tidal lines
- Tide gaging stations
- Currents
- Icebergs, sea-ice
- Submarine relief: soundings, contours
- Sea-floor: composition, deposits, etc.
- Ocean water: composition, temperature, etc.

Coastal topographic maps
Hydrographic charts

IV. INLAND SEAS, RIVERS, AND WATERWAYS; DRAINAGE

Maps showing
- Lake surveys: relief and bathymetry
- Ponds, bogs, marshes, wet lands
- Rivers and river basins, canals
- Stream gaging stations; stand and flow at different points, at various seasons
- Seasonal streams (winter bournes)
- Erosion and sedimentation

Water problems
- Flood control
- Low water control
- Navigation

B. PHYSICAL GEOGRAPHY (Cont.)

V. CLIMATOLOGY AND METEOROLOGY

Maps showing
- Climatic regions
  - Tropical
  - Sub-tropical
  - Cyclonic
  - Polar
- Climatic changes
- Precipitation: rain, snow, etc.
- Temperature, humidity (isobar maps)
- Length of growing season
- Barometric pressure
- Cloudiness, fog
- Storms: storm areas and frequency
- Frost

Location of meteorological stations

Location of co-operative weather stations

VI. TERRESTRIAL MAGNETISM

Maps showing
- Magnetic variation and deflection

C. BIOGEOGRAPHY (Plant and Animal)

I. PLANT GEOGRAPHY (Botany and Plant Ecology)

Maps showing
- General vegetation (natural and semi-natural)
- Woodland and shrub
- Moorland and heath
- Grassland
  - Prairie
  - Steppe
  - Tundra
- Fen and fresh water marsh
- Aquatic vegetation
- Saltmarsh, dunes, shingle
- Marine vegetation

Advanced ecological studies
- Life histories of plant species in relation to environment
- Regional flora

I. PLANT GEOGRAPHY (Botany and Plant Ecology) (Cont.)

Forest service
- Culture
- Timber stands (types)
- Re-forestation
- Cut-over lands

II. ANIMAL GEOGRAPHY (Zoology and Animal Ecology)

Maps showing distribution of
- Wild animals
  - Terrestrial
  - Surface
  - Sub-terranian
  - Aerial
  - Marine
    - Fresh water
    - Salt water
  - Marine littoral
  - Pond and river fauna

Life zones
Migration routes
Game refuges
Bird sanctuaries

Life histories of animal species in relation to environment

D. HUMAN AND SOCIAL GEOGRAPHY

I. POPULATION DISTRIBUTION (urban, rural, regional)

Maps showing distribution by
- Density
- Race
- Color
- Sex
- Nationality
- Place of birth
- Language
- Education
- Illiteracy
- Religion
- Age and age groups
- Birth rate
- Death rate
- Marriage rate
- Divorce rate

Size of family
Number of children per family
- Of native parents
- Of immigrant parents

D. HUMAN AND SOCIAL GEOGRAPHY

I. POPULATION DISTRIBUTION (urban, rural, regional) (Cont.)

Maps showing distribution by
- Mobility
  - Intra-regional
  - To and from region
- Occupation
  - Professional
  - Proprietary
  - Clerical
  - Skilled
  - Semi-skilled
  - Unskilled
- Employment
  - Gainful workers in percentage of population
  - Gainful workers engaged in commodity production
  - Gainful workers engaged in building industry
  - Gainful workers engaged in manufacturing and mechanical industries
  - Gainful workers engaged in agriculture
  - Gainful workers engaged in service occupations
- Home ownership
- Home tenancy
- Size of home rentals paid
- Income classes
- "Natural areas"
  - Residential enclaves, settlements
- Number of relief cases
  - Direct relief
  - Work relief

II. VITAL STATISTICS: BIRTHS, DEATHS, DISABILITY

Maps showing distribution of
- Birth rates
  - Native stock
  - Foreign stock
  - Mixed stock
- Death rates
  - All causes
  - Specific causes

II. VITAL STATISTICS: BIRTHS, DEATHS, DISABILITY (Cont.)

Maps showing distribution of
- Death rates
  - Infant mortality
- Survival rates
  - In different areas
- Morbidity and disability
  - Physical
  - Mental
  - Occupational
- Infected areas
- Quarantined areas
- Health districts

Note: see also further on under Social Welfare Work, and also under Social Pathology

III. THE FAMILY, MARRIAGE, DIVORCE

Maps showing distribution of
- Families by
  - Race
  - Color
  - Nationality
  - Place of birth
  - Age
  - Size
  - Occupation
  - Income
  - Number of members gainfully employed
  - Status
    - Social
    - Cultural
    - Economic
- Marriages by
  - Race
  - Nationality
  - Age, etc.
- Divorces, desertions
- Children of divorced parents

IV. HOUSING

Maps showing distribution of
- Dwellings by
  - Size
    - Single family
    - Multi-family

D. HUMAN AND SOCIAL GEOGRAPHY

IV. HOUSING (Cont.)

Maps showing distribution of
- Dwellings by
  - Cost and type of dwelling
    - Low cost
    - High cost
      - Estate
      - Private residence
      - Hotel
        - Apartment hotel
      - House
        - Apartment house
        - Tenement
        - Rooming and boarding house

  - Location
    - Country
    - Suburb
    - Resort
    - City
      - Residential district
      - Business district
      - Slum district
      - "Natural areas"
      - Settlements
        - Native
        - Foreign

  - Ownership
    - Private
    - Public
    - Corporate
    - Co-operative
    - In receivership

  - Tenancy
  - Occupancy
  - Vacancy
  - Historical associations

V. EDUCATIONAL INSTITUTIONS

Maps showing distribution of
- Schools
  - Public
  - Private
  - Endowed
  - Tax exempt
  - Denominational
    - Theological
    - Missionary

  - Elementary
  - Secondary
  - Higher
    - Academies

V. EDUCATIONAL INSTITUTIONS (Cont.)

Maps showing distribution of
- Schools
  - Higher
    - Colleges
    - Professional
    - Universities

  - School funds
  - School attendance
  - Schools under construction

VI. LIBRARIES

Maps showing distribution of
- Libraries
  - Public
  - Private
  - Institutional
  - Endowed

  - By resources
  - By area served
  - By population served

VII. RELIGION, AND DENOMINATIONAL INSTITUTIONS

Maps showing distribution of
- Religious creeds
- Denominations, faiths, sects, etc.

- Bishoprics
- Dioceses
- Parishes
- Deaneries

- Churches
- Monasteries
- Nunneries
- Convents

- Theological seminaries
- Missionary schools
- Mission stations
- Parochial schools

VIII. RECREATIONAL FACILITIES

Maps showing distribution of
- National parks and forests
- Historical parks and sites
- Municipal and county parks, playgrounds, beaches, etc.
- Hunting, game, and fishing grounds
- Child and adult recreational camps
- Tourist and sportsmen's camps

D. HUMAN AND SOCIAL GEOGRAPHY (Cont.)

IX. CLUBS, SOCIETIES, LODGES, FRATERNITIES, ETC.

Maps showing the distribution of these institutions according to

- Charter
- Purpose
- Activities
- Benefits to be derived
- Size of membership
- Resources
- Location

X. SOCIAL WELFARE WORK, AND INSTITUTIONS

Maps showing distribution of

- Free medical clinics and dispensaries
- Public welfare bureaus
- Public health inspection districts

- Public and semi-public institutions
  - Hospitals
  - Health sanatoriums
  - Orphanages
  - Homes for the aged
  - Homes for invalids, the blind, etc.
  - Child-welfare institutions
  - Family-welfare institutions
  - Shelters for transients and homeless
  - Social-service settlements

- Municipal lodging houses
- Poor relief
- Unemployment relief
  - Direct relief
  - Work relief
- Free employment service agencies
- Old-age pensions
  - Public
  - Private
- Minimum-wage laws
- Maximum-hours laws
- Child-labor laws
- Workmen's compensation laws

XI. SOCIAL PATHOLOGY

Maps showing distribution of

- Mental defectives
- Institutional inmates
- Detention institutions
  - Penal institutions
  - Psychopathic hospitals
  - Asylums

- Crime and vice
  - Individual
  - Organized and protected
  - Related to population density
  - Related to environment, personal data
- Delinquency
  - Juvenile delinquency
  - Delinquency patterns
  - Truancy

- Suicides
- Homicides
- Race prejudice

E. POLITICAL GEOGRAPHY

I. BOUNDARIES

Maps showing

- Boundaries with adjacent states and political entities
- Boundaries with the high seas and territorial waters

II. MAJOR POLITICAL DIVISIONS, AND ADMINISTRATIVE DEPENDENCIES

Maps showing

- Monarchies
- Republics
- Federated states
  - Dominions
  - Commonwealths
  - Mandates
  - Protectorates
  - Extra-territorialities
  - Buffer states
  - Neutral zones
  - Colonial possessions
  - Claims to sovereignty
  - Political spheres of influence
  - Free ports of entry

E. POLITICAL GEOGRAPHY

II. MAJOR POLITICAL DIVISIONS, AND ADMINISTRATIVE DEPENDENCIES (Cont.)

Maps showing
- Federated states
  - International waterways
  - Embassies
  - Consular districts

III. POLITICAL (ADMINISTRATIVE) SUB-DIVISIONS

Maps showing
- States, provinces, territories
- Counties
- Cities
- Municipalities
- Towns and townships
- Boroughs
- Districts

Minor civil divisions
- Incorporated
- Un-incorporated

IV. CITY AND CITY PLANNING

Master plan
Official city map
Zoning maps
- Present zones
- Future zones

City growth maps
- Growth by annexation
- Growth by reclamation

Maps showing
- Election precincts
- Magisterial precincts
- Jury wards
- Police districts
- Police beats
- Health-inspection districts
- School-board districts
- Park-board districts
- Fire-control districts
- Water-supply districts
- Sanitary districts

V. POLITICAL ELECTION DATA

Maps showing
- Election districts
- Election results

V. POLITICAL ELECTION DATA (Cont.)

Maps showing
- Election results
  - National
    - Presidential
    - Party
  - Local

F. LAND CLASSIFICATION

Maps showing
- Total land area
  - Unoccupied (vacant)
  - Occupied and improved
    - Privately developed
    - Developed for public or semi-public use

Major land forms
- Mountains
- Hill-country
- Plains
- Plateaus

Natural land divisions
- Arctic
- Ice
- Tundra
- Temperate
  - Pedalferic
  - Pedocalic
- Tropic
  - Pedalferic
  - Pedocalic

Use divisions
- Agriculture
- Mining, industry
- Urban

Land of little or no use

G. LAND UTILIZATION MAPS (Economic and Commercial)

I. AGRICULTURE AND AGRICULTURAL ECONOMICS

1. Land Classification

Maps showing
- Types of land areas according to
  - Soil type and soil texture

G. LAND UTILIZATION MAPS (Economic and Commercial)

I. AGRICULTURE AND AGRICULTURAL ECONOMICS

1. Land Classification (Cont.)

Maps showing
- Types of land areas according to
  - Topography
    - High and broken land, etc.
    - Low plateau land
  - Vegetation
  - Precipitation
  - Temperature
  - Length of growing season
  - Productivity
    - High
    - Low
    - Medium
    - Submarginal

- Types of land as conditioned by
  - Water problems
    - Dry land belts
    - Wet land belts
    - Irrigable land
    - Non-irrigable land
    - Delta land protected from all floods
    - Delta land subject to floods
    - River bottom land
    - Floodway land

- Correlation of climate to
  - Crop selection
  - Crop yield
  - Use of pastures, etc.

- Problem areas
  - Erosion
    - Rill, fingering or shoestring
    - Gulley
    - Sheet
    - Wind

2. Land Utilization

Maps showing
- Percentage of
  - Total land area in farms
  - Total land tillable
  - Tillable lands in farms

2. Land Utilization (Cont.)

Maps showing
- Area and distribution of
  - Occupied farm land
    - Improved
    - Unimproved
  - Abandoned farm land
  - Harvested crop land
    - By individual crops
  - Idle and fallow farm land

- Land used in
  - Live stock breeding
  - Stock grazing
  - Pasturing
  - Dairy farming
  - Fruit farming
  - Sericulture
  - Viticulture
  - Apiculture
  - Specialized plantations
    - Cotton
    - Sugar
    - Rubber
    - Coffee, etc.
  - Mixed farming
  - Hunting
  - Fishing

- Woodland in farms
  - Pastured
  - Not pastured

- Forestry lands
  - Types according to species
    - Pine lands
    - Oak, hickory, etc.

3. Farm Economics

Maps showing
- Value-distribution of
  - Harvested field crops
  - Fruit and vegetable crops
  - Animal products
  - Cultivated crop production ratio
  - Live stock production ratio
  - Areas harvested per gainful worker
  - Farm income
  - Farm improvements
    - Per acre value of farm real estate
    - Power farming machinery
    - Silos

G. LAND UTILIZATION MAPS (Economic and Commercial)

I. AGRICULTURE AND AGRICULTURAL ECONOMICS

3. Farm Economics (Cont.)

Maps showing
Value-distribution of
Farm improvements
Motorcars
Pleasure cars
Trucks
Electricity and gas
Telephones
Radios
Drainage

Density of
Farm population
Farm dwellings

4. Land Tenure

Maps showing
Number, acreage, and distribution of farms operated by
Owner
Manager
Tenant
Commercial farm societies

Acreage and distribution of
Land disposed of by grant
Leased grazing and pastoral land
Land acquired for settlement
National endowment land
Homestead land

II. BANKING AND FINANCE

Maps showing distribution of
Banks
Federal reserve
National
State
Mutual savings
Home loan
Farm loan
Investment
Private
Chain
Group

Stock exchanges

II. BANKING AND FINANCE (Cont.)

Maps showing distribution of
Produce exchanges
Trust companies
Investment trusts
Finance companies
Stock and bond houses
Real estate brokerage houses
Insurance companies, etc.

Area served per institution
Population served per institution

III. TRADE AND COMMERCE

Maps showing
Wholesale trade and jobbing centers
Retail shopping areas
Consumers' trading areas
Neighborhood shopping centers
Chain stores

Co-operative marketing areas
Co-operative marketing associations
Consumers' leagues, and stores

Local, municipal, state markets
Local and out of state markets
Fairgrounds

Retail trade
Per capita
Per product
Per district
Wholesale trade
Per capita
Per product
Per district

IV. TRANSPORTATION AND COMMUNICATION

1. Rail Transportation

Maps showing
Steam lines
Electric lines
Motorized lines
Trunk lines

G. LAND UTILIZATION MAPS (Economic and Commercial)

## IV. TRANSPORTATION AND COMMUNICATION

1. Rail Transportation (Cont.)

Maps showing
- Motorized lines
  - Belt lines
  - Urban lines
  - Inter-urban lines
- Railroad crossings
  - Level
  - Overhead
  - Underhead
- Terminals
  - Passenger
  - Freight
- Freight yards
- Switch yards
- Round houses
- Freight differentials
  - Long haul
  - Short haul
- Traffic problems

2. Highway Transportation

Maps showing distribution of
- Highways
  - Main connecting
  - Trunk
  - Express
  - Radial
  - Arterial
  - Circumferential
  - Inner
  - By-pass routes
    - Overpass
    - Underpass
  - Minor regional
- City streets
  - Through streets
  - Boulevards, parkways, etc.
- Federal-aid highway system
- Road progress
- Road condition
- Construction of roads
  - Concrete
  - Bituminous concrete
  - Brick
  - Asphalt
  - Macadam

2. Highway Transportation (Cont.)

Maps showing distribution of
- Construction of roads
  - Bituminous macadam
  - Gravel
  - Stamp sand
  - Grading and drainage
- Traffic problems
  - Lane capacities
  - Traffic congestion points
    - Intensity
    - Periodicity
  - Traffic accidents
    - Location and frequency
    - Type of accident and frequency
    - Automatic signaling devices
    - Transit problems

3. Water Transportation

Maps showing
- Navigable lakes and waterways
- Intra-coastal waterways
- Rivers and canals
- Shipping routes
  - Passenger
  - Freight
  - Mixed
- Locks
- Dams
- Reservoirs
- Harbor facilities
  - Ports
  - Wharves
  - Docks and docking
- River and harbor improvement
  - Flood control projects
  - Dredging, etc.

4. Aerial Transportation

Maps showing
- Aerial routes
  - Passenger
  - Freight
  - Mail
  - Mixed
- Air ports
- Seaplane ports
- Landing fields

G. LAND UTILIZATION MAPS (Economic and Commercial)

IV. TRANSPORTATION AND COMMUNICATION

4. Aerial Transportation (Cont.)

Maps showing
- Hangars
  - Private
  - Public
- Radio-range beacons
- Radio-marker beacons

5. Pipe Lines

- Oil
- Gas, etc.

6. Communication

Maps showing distribution of
- Telephone and telegraph lines
  - Overland
  - Underground
  - Sub-marine
- Wireless stations
  - Government operated
  - Privately operated
  - National hook-ups
  - Short wave
  - Long wave
  - Assigned radio frequencies
  - Assigned kilowatt power
- Post routes
  - Land routes
  - Air-mail routes
  - Railroad-mail routes
- Movie news-reel outlets
- Newspapers
  - City
  - Metropolitan
  - Regional
  - Party organs, etc.

V. WATER SUPPLY AND DRAINAGE

Maps showing
- Sources of water supply
  - Underground water phenomena
    - Artesian wells
    - Shallow wells
    - Deep wells
    - Springs, etc.

V. WATER SUPPLY AND DRAINAGE (Cont.)

Maps showing
- Sources of water supply
  - Surface streams
  - Impounded waters
  - Treated supplies
- Pumping stations
- Reservoirs, aqueducts
- Filtration plants
- Drainage systems and status
  - Sewered areas
  - Sewage disposal plants
  - Refuse disposal
- Status of municipal sewage disposal
  - Areas with adequate treatment
  - Areas needing additional treatment
    - Now
    - Later
  - Sanitary districts

VI. FOOD SUPPLY AND DISTRIBUTION

Maps showing
- Main sources of food supply and by-products
- Distribution of
  - Slaughter houses
  - Cold-storage houses
  - Storage elevators
- Methods of distribution
  - Wholesale markets
  - Retail markets
    - Private
    - Municipal
- Meat-inspection districts

VII. MINING AND MANUFACTURING INDUSTRIES

Maps showing distribution of
- Extractive industries
  - By mineral
  - By kind of mining
  - By classes according to value
- Manufacturing industries
  - Capital goods
    - Light
    - Heavy

G. LAND UTILIZATION MAPS (Economic and Commercial)

VII. MINING AND MANUFACTURING INDUSTRIES (Cont.)

Maps showing distribution of
- Manufacturing industries
  - Capital goods
    - Finished
    - Semi-finished
  - Consumers' goods
- Assembly plants
- Manufacturing districts
- Building and erection industries

VIII. MECHANICAL POWER SUPPLY AND DISTRIBUTION

Maps showing distribution of
- Primary power plants
  - Private
  - Public
    - Steam
    - Water power
      - Developed
      - Potential
    - Gas and oil
- Electric generating stations
  - Private
  - Public
    - Steam generated
    - Hydro-electric
    - Gas and oil
    - Central or super-power stations
    - Sub-stations, converter stations
    - Load capacities
      - Daily
      - Seasonal
      - Potential
      - Peak load
      - Minimum
      - Optimum
      - Average
- Power transmission lines
  - Private
  - Public
    - Interstate
    - Intra-state
    - High tension
    - Low tension
    - Overland
    - Underground
    - Sub-marine

VIII. MECHANICAL POWER SUPPLY AND DISTRIBUTION (Cont.)

Maps showing distribution of
- Gas plants
- Gas-holder stations
- Gas mains

IX. MISCELLANEOUS LAND USES

Maps showing
- National parks
- National forests
- National monuments
- National cemeteries
- National military parks
- Battlefield sites
- Memorials
- Indian reservations
- Railroad grant lands
- State lands, etc.

Note: for residential, cultural, and social land-use maps, see further on under:
- Housing
- Education
- Religion
- Recreation, etc.

H. LAND VALUATION

Maps showing
- Land value
  - Per acre
  - Per frontal foot
  - Per capita

I. LAND OWNERSHIP

Maps showing
- Dominant ownership
  - Private
  - Municipal
  - County
  - State
  - Federal
  - Divided between two or more agencies

J. MILITARY AND NAVAL GEOGRAPHY

Maps showing
- Military districts
- Fortified and "neutral" zones

J. MILITARY AND NAVAL GEOGRAPHY (Cont.)

Maps showing
- Army camps
- Naval bases
- Devastated areas
- Occupied areas
- Historical maps grouped under the names of the wars with which they are identified

K. HISTORICAL GEOGRAPHY

Maps arranged first chronologically, and then geographically and by event, author, or content

# A P P E N D I X  I I

## MAP CLASSIFICATION OUTLINE BY AREAS[1]

### A. Main Divisions

World

- Continents
  - North America
  - South America
  - Europe
  - Asia
  - Africa
  - Australia and the Pacific Islands
- Oceans
  - Atlantic
  - Pacific
  - Indian
  - Arctic

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[1]This outline was prepared by Colonel Lawrence Martin, Chief Division of Maps, Library of Congress. (Letter dated June 5, 1936.) It is a tentative outline.

B. General Outline

NORTH AMERICA
- United States (including Alaska)
- Greenland
- Arctic Archipelago
- Canada
- Newfoundland and Labrador
- St. Pierre and Miquelon
- Mexico
- Central America
- British Honduras
- Costa Rica
- Guatemala
- Honduras
- Nicaragua
- Salvador
- Panama Republic
- Panama Canal Zone
- West Indies and the Bermudas

SOUTH AMERICA
- Argentine
- Bolivia
- Brazil
- Chile
- Colombia
- Ecuador
- Falkland Islands
- The Guianas
- Guiana, British
- Guiana, Dutch
- Guiana, French
- Paraguay
- Peru
- Uruguay
- Venezuela

EUROPE
- Scandinavia
- Baltic States
- Central Europe
- Balkan States
- The Mediterranean countries
- Albania
- Andorra
- Austria-Hungary
- Austria
- Belgium
- British Isles
- Bulgaria
- Czechoslovakia
- Danzig
- Denmark
- Estonia
- Finland
- France
- Germany
- Gibraltar

EUROPE (Cont.)
- Greece
- Hungary
- Iceland
- Italy
- Latvia
- Liechtenstein
- Lithuania
- Luxemburg
- Malta
- Monaco
- The Netherlands
- Norway
- Poland
- Portugal
- Rumania
- Russia
- Russia in Europe
- San Marino
- Spain
- Sweden
- Switzerland
- Turkey in Europe to 1912
- Yugoslavia

ASIA
- Southeastern Asia
- Indo-China and Malaya
- Aden
- Afghanistan
- Arabian States
- Asir, see Arabian States
- Baluchistan, see India, Provinces
- Bhutan
- Ceylon
- China
- Cyprus
- Dutch East Indies
- Federated Malay States, see Malaya
- French Indo-China
- Hejaz, see Arabian States
- Hong Kong
- Iran, see Persia
- India
- Iraq (Mesopotamia)
- Japan (including Korea)
- Kuwait, see Arabian States
- Malaya (including Federated Malay States, Malay States not federated and Straits Settlements)
- Nejd, see Arabian States
- Nepal
- Oman (Muscat), see Arabian States

ASIA (Cont.)
- Palestine and Transjordan, including Bible Lands
- Persia
- Philippine Islands
- Russia in Asia
- Saudi Arabia, see Arabian States
- Siam
- Straits Settlements, see Malaya
- Syria and the Lebanon
- Turkey (including Turkish Empire, Turkey in Asia, and Republic of Turkey)
- Yeman, see Arabian States

AFRICA
- Northern Africa (including Barbary States)
- Central Africa
- Southern Africa
- Algeria
- Anglo-Egyptian Sudan
- Angola
- Basutoland
- Bechuanaland
- Belgian Congo
- Cameroons
  - Cameroons, British
  - Cameroon, French
- Egypt
- Eritrea
- Ethiopea
- French Equatorial Africa
- French West Africa
- Gambia
- Gold Coast
- Kenya
- Liberia

AFRICA (Cont.)
- Libya
- Madagascar
- Morocco
- Mozambique
- Nigeria
- Nyasaland
- Portuguese Guinea
- Rhodesia
- Rio de Oro
- Rio Muni
- Sierra Leone
- Somaliland
  - British Somaliland
  - French Somaliland
  - Italian Somaliland
- South-West Africa
- Swaziland
- Tanganyika
- Togoland
  - British Togoland
  - French Togoland
- Tunisia
- Uganda
- Union of South Africa
- Zanzibar
- East African Islands
- West African Islands

AUSTRALIA AND PACIFIC ISLANDS; OCEANICA
- Australia
- Pacific Islands
- Antarctica

OCEANS
- Atlantic Ocean
- Pacific Ocean
- Indian Ocean
- Arctic Ocean

# A P P E N D I X  I I I

## STATE GOVERNMENTS OF THE UNITED STATES AS MAP SOURCES

The principal map sources of the state governments are the state geological surveys and the state highway departments. Secondary sources are the state agricultural experiment stations which issue county soil maps, the state departments of agriculture, and the public utility and tax commissioners offices. The remarks which follow refer to the major mapping agencies only.

### (1) State Geological Surveys[1]

The term "state geological surveys," as applied herein includes the bureaus of economic geology, the bureaus of mines, the geological and natural history surveys, and so forth, whose investigations extend into the field of geology.[2] Such organiza-

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[1]The principal source of information respecting the organization and work of the state geological surveys is, Morris Morgan Leighton, "Summary Information on the State Geological Surveys and the United States Geological Survey," National Research Council, Bulletin No. 88 (November, 1932). An earlier report of this same nature was issued by the United States Geological Survey in 1911, as Bulletin 465.

[2]A list of the different titles is as follows: Arizona.--Bureau of Mines; Arkansas.--Bureau of Mines; California.--Division of Mines, Department of Natural Resources; Connecticut.--Geological and Natural History Survey; Georgia.--Division of Geology, Department of Forestry and Geological Development; Idaho.--Bureau of Mines and Geology; Indiana.--Bureau of Mineral and Topographic Survey; Michigan.--Geological Survey Division, Department of Conservation; Mississippi.--Geological, Economic, and Topographical Survey; Missouri.--Bureau of Geology and Mines; Montana.--State Bureau of Mines and Geology; Nevada.--Bureau of Mines; New Jersey.--Division of Geology and Waters, Department of Conservation and Development; New Mexico.--State Bureau of Mines and Mineral Resources; North Carolina.--Division of Mineral Resources, Department of Conservation and Development; Pennsylvania.--Topographical and Geological Survey; South Dakota.--Geological and Natural History Survey; Texas.--Bureau of Economic Geology; Virginia.--State Geological and Economic Survey; Washington.--Division of Geology, Department of Conservation and Development; Wisconsin.--Geological and Natural History Survey.

tions have been established in nearly every state of the Union. The states which are at present without a formal agency of this nature are: Delaware, Kentucky, Louisiana, Massachusetts, Oregon, Rhode Island, and Utah. Kentucky discontinued her geological survey in 1932, and replaced it by a Bureau of Mineral and Topographical Survey in care of a single executive officer or state geologist; Louisiana abolished her survey in 1920, although geological research is being continued by the department of geology at the state university, through a working arrangement with the Department of Conservation; and Utah created a department of geology with a governing board in 1930, but made no appropriations for its activities. Finally may be noted the states of Arkansas, Maine, and Vermont, in which geologic survey work is in the care of a "state geologist," and the state of New Hampshire which retains a geologist on the staff of its highway department.

The functions of the state geological surveys, although of varying scope from state to state, usually include the following items: (1) study of the geologic formation of the state with special emphasis on mineral resources and their economic and most profitable exploitation; (2) publication of geologic and economic maps, and of illustrated reports; (3) cooperation with the United States Geological Survey in topographic, geologic, and hydrographic work.[3] There is also frequent state cooperation with other Federal government agencies, notably with the Bureau of Chemistry and Soils.

The results of these activities, as expressed in maps and reports, are excellently listed in the bibliographical volumes which the United States Geological Survey issues from time to time in its bulletin series, under the title of Bibliography of North American Geology. For example, the state survey publications for 1933 and 1934 are listed in Bulletin 869, which was issued by the Government Printing Office in 1935. The earlier publications are contained in bulletins 746-47, 823, 834, and 858. A heading for "geologic maps" is included in the very comprehensive index which is a major feature of these volumes. Attention may also be called

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[3]See the items listed in footnote 1, for details concerning the scope of activities of the individual state geological surveys; see also M. M. Leighton, "The Functions of the State Geological Surveys," Journal of the Association of State Geologists, V (April 1, 1934), 4-6.

to the Catalogue of Small-Scale Geological Maps useful for broader regional studies, with chief emphasis on modern maps. The catalogue was compiled by Walter H. Bucher and was published in mimeographed form, in 1933, by the National Research Council, Washington, D.C. Its map entries are listed in chronological sequence under the following geographical headings: North America (as a whole), Alaska, Canada, United States (by states). Mexico, Central America, and the West Indies.[4] For more recent information concerning the mapping activities of the state surveys recourse may be had to their annual reports or, best of all, to correspondence with the officials in charge of the surveys. A complete listing of their names and addresses may be found in the Council of State Governments' current "Handbook of the States," cited in full on page 337, preceding. Nearly all the state surveys have their headquarters on the premises of the state universities. A number of the surveys publish from time to time a list of their publications, either as a separate leaflet or as supplementary pages to their reports. A brief review of the more outstanding activities and accomplishments of the individual state surveys is included in the annual editions of the American Yearbook.

The list of geologic maps of states which follows, was in substance made available by the United States Geological Survey. It is included here through the kind permission of the Survey's Director, Dr. W. C. Mendenhall, who also very obligingly proofread the list.

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[4]For geological publications of countries other than North America there is issued since 1933 an annual Bibliography and Index of Geology Exclusive of North America. It is published by the Geological Society of America, with editorial offices at Columbia University, New York.

# List of Geologic Maps of States

ALABAMA

Geologic Map 1:500,000

(In Special Report No. 14 of Alabama Geological Survey, 1926; also separately at price of $1. Compiled by C. Butts, L. W. Stephenson, C. W. Cooke, and G. I. Adams. Printed by U.S. Geological Survey.)

ARIZONA

Geologic Map 1:500,000

(1924. Issued by Arizona Bureau of Mines. Price $2.50. Compiled by N. H. Darton, C. Lausen, and E. D. Wilson. Printed by U.S. Geological Survey.)

ARKANSAS

Geologic Map 1:500,000

(1929. Issued by Arkansas Geological Survey. Price $1.80. Compiled by G. C. Branner. Printed by U.S. Geological Survey.)

CALIFORNIA

Geologic Map 1:2,000,000

(1915. In U.S. Geological Survey Water Supply Paper 338, Plate II. Compiled by G. A. Waring.)

Geologic Map 1:750,000

(1929. Issued as separate map by State Bureau of Mines. Price $.75. Compiled by J. A. Smith.)

Fault Map of California, scale 1 in. to 8 mi.

(1922. Compiled by B. Willis and H. O. Wood from data assembled by the Seismological Society of America and published by the Society. Printed by U.S. Geological Survey. Price $5.)

CALIFORNIA (Cont.)

Note: A new geologic map of the state, compiled by O. P. Jenkins, is to be published by the State Division of Mines on the scale of 1:500,000.)

COLORADO

Geologic Map 1:500,000

(1936. Compiled by U.S. Geological Survey and Colorado Geological Survey. Printed by U.S. Geological Survey. Price $2.)

CONNECTICUT

Geologic Map, Preliminary, 1:250,000

(In Bulletin 7 of Connecticut Geological and Natural History Survey, 1906. Compiled by H. E. Gregory and H. H. Robinson.)

Geologic and Economic Map, Preliminary, Part of Connecticut 1:500,000

(1923. In U.S. Geological Survey Bulletin 738, Plate XXVIII.)

Glacial Geology Map of Connecticut 1:125,000

(In Bulletin 47 of Connecticut Geological and Natural History Survey, 1930. Compiled by Richard F. Flint.)

DELAWARE

Note: No separate geologic map is available; but see the geologic map of Maryland, issued by the Maryland Geological Survey in 1933; it includes Delaware.

DISTRICT OF COLUMBIA

Note: Consult the Geologic map of Maryland.

FLORIDA

Geologic Map 1:1,000,000

(In 20th Annual Report of the Florida Geological Survey, 1929, Plate 2. Compiled by C. W. Cooke and Stuart Mossom. Printed by U.S. Geological Survey. Price $.10.)

GEORGIA

Geologic Map, Preliminary, 1:1,000,000

(In Bulletin No. 15 of Geological Survey of Georgia, 1908, opposite page 33. Compiled by S. W. McCallie and O. Veatch.)

Geologic Map of Coastal Plain of Georgia 1:1,000,000

(In Bulletin 26 of Geological Survey of Georgia, 1911, opposite page 58; also in U.S. Geological Survey Water Supply Paper 341 [1914].)

Geologic Map of the Appalachian Valley and Cumberland Plateau in Georgia, scale 1 in. to 4 mi.

(In Bulletin 27 of Geological Survey of Georgia, 1911, opposite page 128. Compiled by T. P. Maynard.)

Geologic Map, Outline, 1 in. to 70 mi.

(In Bulletin 39 of Geological Survey of Georgia, 1922. Compiled by S. W. McCallie.)

IDAHO

Note: No separate geologic map is available; but see under United States, geologic map, scale 1:2,500,000, issued by U.S. Geological Survey.

ILLINOIS

Geologic Map 1:500,000

(1917. Compiled by F. DeWolf. Published separately by Illinois Geological Survey. Price $.50.)

INDIANA

Geologic Map, scale 1 in. to 4 mi.

(In 28th Annual Report of Indiana Department of Geology and Natural Resources, 1903. Compiled by T. C. Hopkins.)

Geologic Map 1:2,500,000

(In U.S. Geological Survey Bulletin 522 [1912], Plate XV.)

Geologic Map, scale 1 in. to 16 mi.

(In Publication 8 of Department of Conservation, Division of Geology, 1920. Compiled by W. N. Logan.)

Geologic Map 1:253,400

(1932. Indiana Geological Survey.)

IOWA

Geologic Map 1:500,000

(1937. Compiled by A. C. Tester, Iowa Geological Survey. Edited by G. W. Stose.)

KANSAS

Geologic Map 1:500,000

(1937. Compiled by R. C. Moore and K. K. Landes, State Geological Survey of Kansas. Price $1.)

KENTUCKY

Geologic Map 1:500,000

(1929. Compiled by W. R. Jillson, Kentucky Geological Survey. Printed by U.S. Geological Survey. Price $1.50.)

LOUISIANA

Geologic Map 1:1,300,000

(In black only. Included in Bulletin of Louisiana Department of Conservation, 1930.)

Map of Tertiary Deposits of Mississippi Embayment, scale 1 in. to 50 mi.

(In Report of Geological Survey of Louisiana [1902], Part VI, Plate I. Compiled by G. D. Harris.)

MAINE

Geologic Map 1:500,000

(1933. Issued by Geological Survey of Maine. Compiled by A. Keith. Obtainable free.)

MARYLAND

Geologic Map, scale 1 in. to 6 mi.

(1933. Compiled by E. B. Matthews, Maryland Geological Survey.)

MASSACHUSETTS

Geologic Map 1:250,000

(In U.S. Geological Survey Bulletin 597 [1916], Plate X. Compiled by B. K. Emerson.)

MICHIGAN

Geologic Map, Centennial, 1:500,000

(1936. Issued in October, 1937 by Michigan Geological Survey Division, Department of Conservation. Price ? Compiled by Helen M. Martin.)

MINNESOTA

Geologic Map 1:500,000

(1932. Minnesota Geological Survey. Printed by U.S. Geological Survey.)

MISSISSIPPI

Geologic Map, scale 1 in. to 13 mi.

(1910. Published separately by Mississippi Geological Survey. Compiled by A. F. Crider.)

Geologic Map, scale 1 in. to 20 mi.

(In Bulletin 12 of Mississippi Geological Survey, 1915. Compiled by E. N. Lowe. See also U.S. Geological Survey Bulletin 522 [1912], Plate II, showing map on scale of 1:2,500,000.)

Sketch Geologic Map

(In Ninth Biennial Report of Mississippi Geological Survey, 1923.)

MISSISSIPPI (Cont.)

Reconnaissance Map 1:1,000,000

(In U.S. Geological Survey Water Supply Paper 576 [1928]. Compiled by L. W. Stephenson. Also published separately, price 25¢.)

MISSOURI

Geologic Map 1:500,000

(1926. Separately issued. Compiled by H. A. Buehler, Missouri Bureau of Geology and Mines.)

MONTANA

Note: No geologic map of the entire state is available, although a new map on the scale of 1:500,000 is being compiled (1934-37) by the U.S. Geological Survey and the state geological survey. See, however, under United States, geologic map, 1:2,500,000)

Geologic Map, Preliminary, of Central and Eastern Montana 1:100,000

(In Bulletin 4, University of Montana, State Bureau of Mines and Metallurgy, 1921. Compiled by G. S. Lambert.)

Manuscript Map of Western Part of State 1:500,000

(On file in the University of Montana. Compiled by G. S. Lambert.)

NEBRASKA

Geologic Map, Preliminary, 1:2,500,000

(In U.S. Geological Survey Professional Paper 17 [1903], Plate IX. Compiled by N. H. Darton.)

Geological Map of Central Great Plains Part of State, scale 1 in. to 20 mi.

(In U.S. Geological Survey Professional Paper 32 [1905], Plate XXXV. Compiled by N. H. Darton.)

NEVADA

Note: No separate geologic map is available; consult, however, the United States geologic map noted further on.

NEW HAMPSHIRE

Geologic Map of New Hampshire and Vermont, scale 1 in. to 9 mi.

(Compiled by C. H. Hitchcock and published by him in "Geology of Northern New England," 1877.)

Geologic Map, scale 1 in. to 2½ mi.

(In Atlas accompanying report on Geology of New Hampshire, by New Hampshire Geological Survey, 1878. Compiled by C. H. Hitchcock.)

Geologic Map, scale 1 in. to 13 mi.

(In New Hampshire Academy of Science, Handbook No. 1 [1925] Map compiled by J. W. Goldthwait.)

NEW JERSEY

Geologic Map 1:250,000

(Compiled by J. V. Lewis and H. B. Kümmel and issued separately in 1912 by New Jersey Geological Survey. Reprinted in 1931 with revision by Kümmel.)

NEW MEXICO

Geologic Map 1:500,000

(Issued separately and also included in U.S. Geological Survey, geologic folio, 1928. Compiled by N. H. Darton and edited by G. W. Stose. Price $1.50.)

NEW YORK

Geologic Map 1:312,500

(Compiled by F. J. H. Merrill. Issued by New York State Museum as a separate map. 1901.)

NORTH AMERICA

Geologic Map 1:5,000,000

(In U.S. Geological Survey Professional Paper 71 [1912], Plate I. Compiled by Bailey Willis and G. W. Stose.)

NORTH CAROLINA

Economic Geology Map of Western North Carolina, scale 1 in. to 25 mi.

(In Bulletin 3 of North Carolina Geological Survey, 1896. Compiled by J. A. Holmes.)

Geologic Map of Coastal Plain of North Carolina, scale 1 in. to 15 mi.

(In Vol. 3 of Reports of the North Carolina Geological Survey, 1912, Plates 13 and 17. Compiled by L. W. Stephenson, W. B. Clark, and others.)

NORTH DAKOTA

Geologic Map, Outline ("poor and small scale")

(In Vol. 7 of North Dakota University Quarterly Journal, 1919; also in Vol. 27 of Journal of Geology, 1919, opposite page 3. Compiled by A. G. Leonard.)

OHIO

Geologic Map 1:500,000

(1920; reprinted 1929. Compiled by J. A. Bownocker, Ohio Geological Survey. Separately published. Price $1.)

OKLAHOMA

Geologic Map 1:500,000

(Included in U.S. Geological Survey, geologic folio, and also obtainable separately at price of $1.75, from Oklahoma Geological Survey. Compiled by H. D. Miser and edited by G. W. Stose.)

OREGON

Geologic Sketch Map ("poor and small scale")
(In Vol. 6, new series of Com-

OREGON

Geologic Sketch Map....(Cont.)

monwealth Review of the University of Oregon [Dec.1924], Figure 2.)

PENNSYLVANIA

Geologic Map, scale 1 in. to 6 mi.

(1931. Compiled by G. W. Stose, O. A. Ljungstedt and A. I. Jonas. Pennsylvania Geological Survey. Price $1.50.)

RHODE ISLAND

Geologic Map of Massachusetts and Rhode Island 1:250,000

(In Bulletin 597 of U.S. Geological Survey, 1916, Plate X. Compiled by B. K. Emerson.)

SOUTH CAROLINA

Geologic Map, Outline, 1:2,000,000

(Frontispiece in Bulletin 2, new series, of South Carolina Geological Survey, 1906 [published in 1908]. Compiled by Earl Sloan.)

Geology of the Coastal Plain 1:500,000

(Compiled by C. W. Cooke, and L. W. Stephenson in manuscript for future publication by U.S. Geological Survey.)

SOUTH DAKOTA

Geologic Map, scale 1 in. to 20 mi.

(In U.S. Geological Survey Water Supply Paper 227 [1908], Plate I. Compiled by N. H. Darton.)

Geologic Map of Northern Black Hills Part of State 1:500,000

(In U.S. Geological Survey Professional Paper 65 [1909], Plate IV. Compiled by N.H. Darton.)

Geologic Map 1:760,320

(1932. Geological Survey of South Dakota.)

SOUTH DAKOTA (Cont.)

Geologic Map 1:500,000

(1937. Compiled by N. H. Darton. Map is in manuscript awaiting publication.)

TENNESSEE

Geologic Map 1:500,000

(1933; reprinted, with changes, from 1923 edition. Tennessee Geological Survey.)

TEXAS

Geologic Map 1:500,000

(1937. Compiled by N. H. Darton, L. W. Stephenson, and Julia Gardner. U.S. Geological Survey. Price $2.50.)

UNITED STATES

Geologic Map of United States 1:2,500,000

(1933. In 4 sheets, each 27 x 47 in. Map is result of more than 50 years of geologic exploration and mapping by U.S. Geological Survey, state surveys and other organizations. More than 160 rock units are distinguished by patterns printed in 23 colors. Published by U.S. Geological Survey. Price $2.50.)

UTAH

Geologic Map, scale 1 in. to 12 mi.

(In U.S. Geological Survey Professional Paper 111 [1919], Plate IV. Compiled by B. S. Butler.)

VERMONT

Geologic Map of New Hampshire and Vermont, scale 1 in. to 9 mi.

(Compiled by C. H. Hitchcock and published by him in "Geology of Northern New England," 1877.)

VIRGINIA

Geologic Map 1:500,000

(1929. Compiled by G. W. Stose, A. I. Jonas, and L. W. Stephenson. Virginia Geological

VIRGINIA

Geologic Map 1:500,000 (Cont.)

Survey. Printed by U.S. Geological Survey. Obtainable at cost of postage.)

Appalachian Valley 1:250,000

(1933. Compiled by Charles Butts. Virginia Geological Survey. Printed by U.S. Geological Survey.)

WASHINGTON

Geologic Map 1:500,000

(1936. Issued by Department of Conservation and Development, State of Washington. Compiled by H. E. Culver. Price $1.)

WEST VIRGINIA

Geologic Map 1:500,000

(1932. Issued by West Virginia Geological Survey. Compiled by G. W. Stose and O. A. Ljungstedt. Price $1.)

WISCONSIN

Geologic Map scale 1 in. to 6 mi.

(1911. Issued by Wisconsin Geological Survey. Compiled by W. O. Hotchkiss and F. H. Thwaites.)

Geological Map of the Lake Superior Region 1:100,000

(In U.S. Geological Survey Professional Paper 184 [1935], Plate I. Compiled by C. K. Leith, R. J. Lund, and A. Leith)

Geologic Map 1:1,000,000

(In Bulletin 66 of Wisconsin Geological and Natural History Survey, 1924, Plate 6. Compiled by Samuel Weidman and revised by E. F. Bean.)

WYOMING

Geologic Map 1:500,000

(Included in U.S. Geological Survey, geologic folio [1925]. Also issued as separate publication, price $1.50. Compiled by M. R. Campbell and others.)

(2) State Highway Departments and Other Map Sources

The state highway department of each state is charged with the planning and administration of the state highway system, including the preparation of state highway maps.[5] It should be observed, however, that the state governments are neither the sole nor the most important dispensers of the highway or road maps of their states. Most of the large oil companies of the country are directly interested in the wide distribution of these maps to the motoring public, and have many millions of copies printed each year by private publishers for this purpose. These are by far the most popular of all maps. They justly enjoy, moreover, a high reputation for accuracy, because each annual reissue is printed from new and carefully revised plates. The basic diagram is obtained from the state base maps of the United States Geological Survey and other governmental sources, but a corps of traveling investigators keeps in touch with state highway departments, rural supervisors and other officials and checks road mileages and the condition and character of construction of roads and bridges. Printing of the maps is usually done by an offset lithographic process on a four-color press.

An official state highway map is probably issued more or less regularly by all the state highway departments, but these maps are not much in evidence as far as the general public is concerned. It is not quite the same with regard to the county highway maps because these are almost entirely prepared by the state highway departments. Quite a number of states have complete sets of these maps. Among them may be mentioned the states

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[5]The comparative lack of uniformity in the administrative set-up of the country's highway systems is shown by the following data. At the beginning of 1937 there were thirty states with two systems, state and county; five southern states with a state organization only; eleven eastern and middle western states with three systems, the largest mileage being under state and township, and a small mileage under county administration; Washington had township mileage in two counties but only two systems, state and county, in the rest of the state. A slow shift toward larger administrative units is discernible. For example, North Carolina, in 1931, put all roads under state jurisdiction; Indiana, in 1932, placed all her township roads under the county system; Virginia, in the same year, transferred all her township roads to the county system; and Michigan, in 1936, completed the transfer of 60,000 miles of township roads to the county system. See the informative article on the current status of the United States highway systems, in Engineering News Record (May 20, 1937), pp. 733-39.

of California, Illinois, North Dakota, West Virginia, and Wisconsin, which have published their county highway maps in the form of bound or loose-leaf atlases. Many other states have, no doubt, sets of county highway maps on file in unpublished manuscript form. Copies of these can usually be obtained on tracing cloth or blue-print paper at the cost of reproduction.[6]

However, a nation-wide project is presently under way which will in time make available the most detailed and comprehensive sets of state and county highway maps that have yet been attempted. This vast undertaking is being carried out by more than forty states in agreement and cooperation with the United States Bureau of Public Roads. According to the Bureau's specifications, the following map series are being produced: (1) statewide sets of county maps on the normal scale of 1 inch to 1 mile, comprising base maps, general highway and transportation maps, bus and truck maps, school bus route maps, and postal route maps; (2) state maps on the scale of 1 inch to 8 miles, consisting of a base map, a highway map, and a transportation map.[7] The consummation of this great project will supply the first uniform sets of state highway maps covering practically the entire nation. Several states have already begun with the publications of these maps, especially the base maps.

In addition to the state geological surveys and the state highway departments there is an undefined number of state government services which are occasional map issuers. It is impossible to record precisely the nature of these services and their product because they vary widely from state to state. All it is possible to do is to enumerate roughly some of the more likely map sources of this description. They may be divided into two classes:

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[6]The number of counties comprised within each state is as follows: Alabama 67, Arizona 14, Arkansas 75, California 58, Colorado 63, Connecticut 8, Delaware 3, Florida 67, Georgia 161, Idaho 44, Illinois 102, Indiana 92, Iowa 99, Kansas 105, Kentucky 120, Louisiana 64, Maine 16, Maryland 24, Massachusetts 14, Michigan 83, Minnesota 87, Mississippi 82, Missouri 115, Montana 56, Nebraska 93, Nevada 17, New Hampshire 10, New Jersey 21, New Mexico 31, New York 62, North Carolina 100, North Dakota 53, Ohio 88, Oklahoma 77, Oregon 36, Pennsylvania 67, Rhode Island 5, South Carolina 46, South Dakota 69, Tennessee 95, Texas 254, Utah 29, Vermont 14, Virginia 212, Washington 39, West Virginia 55, Wisconsin 71, and Wyoming 24. The total number of counties is 3,096.

[7]See United States Department of Agriculture, Bureau of Public Roads, Division of Highway Transport, Planning Survey Memorandum No. 112 (Washington; August, 1936 [Mimeographed]).

(1) those that issue state maps, and (2) those that issue county maps. Among the first may be listed such services as: departments of conservation;[8] departments of public works;[9] public service commissions;[10] public utility commissions; state railroad commissions, and the state planning boards. The list is necessarily incomplete.[11]

Among the state agencies which may publish county maps are: the state agricultural experiment stations;[12] the state geological surveys;[13] and the state tax commissions. Surprisingly few county maps have been published by the counties themselves. However, there can be little doubt that many counties have prepared such maps for their own use and keep them on file in unpublished manuscript form. The most likely county offices where these maps may be found are those of the county clerk, the county surveyor, highway commissioner, and tax assessor.

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[8]Example: The New Jersey Department of Conservation and Development, Division of Geology and Topography, has issued a topographical Atlas of New Jersey, on the scale of 1 mile to 1 inch, consisting of 17 sheets numbered from 21 to 37.

The North Carolina Department of Conservation and Development, Division of Water Resources, issued in 1925 a power map on the scale of 1:1,000,000, of the Southern Appalachian Region, and a similar map in 1932, of the Southwestern United States.

[9]Example: The New York State Department of Public Works, Division of Canals and Waterworks, publishes navigation charts for the state canals.

[10]Example: The Public Service Commissions of New York, Pennsylvania, and New Jersey have cooperated on a Tri-State Power Map (scale approximately 1:730,000) which was issued in 1929.

[11]As examples of the multiplicity of titles these map sources may have, the following maps are cited: (1) the Official Map of California, on the scales of 1/4, 1/8, and 1/12 miles to 1 inch, was recently released by the state "Bureau of Publications and Documents; (2) the Map of Electric Transmission and Distribution Lines in Illinois, on the scale of 1:500,000, was first issued in 1937 by the State Electrification Commission and is now to be transferred to the State Commerce Commission for frequent revision and reissue.

[12]The state agricultural experiment stations prepare county soil maps in cases where Federal government soil maps are lacking or inadequate. In Illinois, for example, the agricultural experiment stations have produced about 55 of these maps.

[13]Examples are the states of Kentucky, Texas, and Virginia, where the state geological surveys appear to perform special and general mapping.

It may perhaps be recalled that the Federal government is by far the most important provider of state maps of various descriptions, and also makes available two types of county maps, namely, county soil maps, issued by the Bureau of Chemistry and Soils, and rural delivery county maps, published by the Post Office Department. A list of the Federal government's state maps is appended to this section.

No bibliographical lists are issued by the states for their maps and other publications. The nearest approach to such a list is the Monthly Checklist of State Publications which the Library of Congress has published since 1910. The annual index of this list includes a heading for maps, but the listing is very incomplete. The most satisfactory way of obtaining precise information regarding official state and county map publications is to write to the map issuing agencies directly. A complete listing of the administrative offices of each state, with names and addresses of their executives, is included in the "Handbook of the States," which is cited on page 339, following.

List of State Maps Issued by the Federal Government

Census Bureau (Department of Commerce)

Maps of minor civil divisions

(1934. Based on the 1930 Census. A map is available for each state. Price per map is 10¢; obtainable from the Superintendent of Documents.)

Coast and Geodetic Survey (Department of Commerce)

Index maps of geodetic control surveys

(A map is issued for each state, showing the location of all the geodetic control surveys within the state, including lines of leveling and traverse and arcs of triangulation. The maps may be used for surveys of all kinds, and are to be had free from the Survey.)

General Land Office (Department of the Interior)

Maps of the public land states, scale 12 mi. to 1 in.

(A map is available for each of the 29 public land states. See page 183 for a note on these maps.)

Geological Survey (Department of the Interior)

Base maps 1:500,000

(A map is available for each state, at 25¢ a map, except the maps of California and Michigan, which are 50¢ each, and the map of Texas which costs $1. The maps show principal cities, towns, streams, railroads and main political subdivisions. See also page 124, preceding. Obtainable from the Survey.)

Base maps 1:1,000,000

(A map is available for each state east of the Mississippi River (except Florida), and for Arkansas, Iowa, Kansas, Minnesota, Missouri, Oregon, and Washington. Obtainable from the Survey at 5¢ each.)

Index-Circulars

(A circular is available for each state [some circulars cover more than one state].) Each circular consists: (1) of an index map showing the progress in geologic and topographic mapping by the Survey within a state, and (2) of a list of the Survey's reports and special maps relating to the state. The circulars are named after the state or states they cover, and are obtainable free from the Survey. They are among the map librarian's most serviceable reference aids.

However, the circulars do not show the topographical quadrangle mapping which may have been done by some other government mapping agency, such as the Mississippi River Commission, or the U.S. Army Corps of Engineers; these two agencies issue their own map lists.

Land classification maps

(1929-34. The 17 maps of this series cover the: Central Great Plains; Northern Great Plains; Utah, and Western Colorado; they show the present and prospective agricultural use of land in the public land states. The maps are on the scale of 1:500,000 (except Utah), and are without contours. They are listed in the catalog of Publications of the United States Geological Survey, and are obtainable at the price of 50¢ each.)

Geological Survey (Cont.)

Special maps

1. Coal maps 1:1,000,000

(Available for: Alabama, Illinois, Indiana, Kentucky, Ohio, and Virginia, at 10¢ each. They show principal coal-producing districts and areas underlain by coal-bearing rocks.)

2. Contour maps

(Various scales. Available for: Connecticut 1:125,000, Massachusetts--Rhode Island 1:250,000, Colorado 1:500,000, New Mexico 1:500,000. The last two cost 75¢ each; the others 50¢ each.)

3. Oil and gas maps 1:500,000

(Available for: California, Louisiana, Oklahoma, Texas, and Wyoming, at 50¢ each. They show oil and gas fields, pipe lines, oil refineries.)

4. Power maps 1:500,000

(Available for: Indiana, Kentucky, Maine, Massachusetts--Rhode Island--Connecticut, New Hampshire--Vermont, New York, Pennsylvania, Virginia, and West Virginia. They show location of power stations, transmission lines, etc., used in public service.)

5. Shaded relief maps

(Available for: Arizona 1:500,000, price $1; Idaho 1:750,000, price 75¢; Kentucky 1:500,000, price 25¢; Ohio 1:280,000, price 25¢; and Tennessee 1:500,000, price 50¢.)

National Park Service (Department of the Interior)

Recreational maps

(See page 188 for a list of the states for which these maps are available.)

Post Office Department

Post route maps

(These maps are available for all the states. A printed list of Official Postal Maps is obtainable free from the Disbursing Clerk, Post Office Department, Washington, D.C. See also page 191 for a note on the maps.)

Public Roads, Bureau of (Department of Agriculture)

Progress maps of Federal-aid highway system

(The maps are available for all of the states. The scale of most of the maps is 1:500,000. See also pages 142 and 179 for notes on these maps.)

Transportation maps 1:250,000

(In progress. Every state is to be covered by a map. Eleven states had been mapped by March, 1937. See page 180 for a note on the maps; they are distributed by the Superintendent of Documents.)

Soil Conservation Service (Department of Agriculture)

Reconnaissance erosion survey maps

(A map has been issued for each of perhaps 36 states. Most of the maps are on the scale of 1:500,000, and some on the scale of 1:1,000,000. See page 145 for a descriptive note on the maps.

Note may also be made of a portfolio of 21 soil conservation maps and a summarized erosion map of the southern Great Plains wind erosion area, which was issued by the Service in 1937, for use with Department of Agriculture Technical Bulletin 556.

# A P P E N D I X  I V

## PUBLIC PLANNING ORGANIZATIONS IN THE UNITED STATES AND THEIR MAP PUBLICATIONS

A considerable amount of valuable map material depicting the distribution of the country's natural, economic, and human resources has recently become available through the far-reaching activities of public planning organizations.[1] Prior to 1933 there were relatively few county planning commissions, and organized state planning scarcely existed. Today, planning is established at every level of government. A brief description of these planning organizations and their map publications is attempted below. They may conveniently be presented under the following headings: (1) Local planning organizations; (2) State planning boards; (3) Regional planning organizations, concerned, respectively, with (a) intra-state planning in Tennessee, (b) metropolitan planning, (c) interstate planning, (d) the Federal planning of the Tennessee Valley Authority; and (4) The National Resources Committee.

### (1) Local Planning Organizations

By local planning organizations is meant the official city planning boards, the municipal zoning boards, and the county planning commissions.[2] The object of these organizations is to

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[1]Information concerning the current activities and publications of all these organizations may conveniently be solicited from the U.S. National Resources Committee, Interior Building, Washington, D.C., or from the headquarters, at Chicago, of the American Society of Planning Officials. Thanks are due, in this latter organization, to Executive Director Walter H. Blucher, and to Assistant Director Paul Oppermann, for valuable aid in the collection of material for this sketch.

[2]See C. I. Hendrickson, County Planning and Zoning--List of Enabling Acts and Commissions as of Jan. 1, 1936 (Washington: U.S. Department of Agriculture, June 1936 [Mimeographed]). Lists of official and unofficial regional planning commissions are included in this pamphlet. Lists of city planning commissions and data concerning the progress of zoning and zoning legislation are issued from time to time in mimeographed form by the Division

obtain a preview of the future growth of their communities, and to give purposive and planful direction to this development. The increase in the number of these agencies has been particularly rapid since 1933, for there are in existence today approximately twelve hundred city planning boards and about four hundred county planning commissions.

A notable development within this local planning group is the apparent favor which the county is gaining as a basic planning unit. It has even been predicted that "the next planning development in the country will be concerned chiefly with the county as the basic planning unit."[3] Indeed, the approximately 3,099 separate areas in the country in which county services are performed, represent in many ways logical and effective planning units, for they all are legal political entities with definite physical boundaries. Moreover, the county has long been the natural unit for rural planning[4] and soil surveys. Just now the U.S. Bureau of Public Roads is actively sponsoring one of the most comprehensive highway planning surveys ever undertaken, and from it will issue, as one of its most notable products, the first uniform set of county highway maps, extending over as many as forty states. Reference may finally be made to the great achievement recently realized in systematic local county planning in Westchester County, New York, as evidenced by the publication of an excellent planning report.[5]

(2) State Planning Boards

The state planning boards occupy a peculiarly strategic position in the ensemble of public planning organizations. Prior

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of Building and Housing of the Bureau of Standards, Department of Commerce.

[3]Joint Conference on Planning, Richmond, 1936. Planning for City, State, Region and Nation; Proceedings of the Joint Conference on Planning . . . . (Chicago: American Society of Planning Officials [1936]), p. 54.

[4]See William E. Cole and Hugh P. Crowe, Recent Trends in Rural Planning (New York: Prentice-Hall, 1937). Pp. 579.

[5]Westchester County Advisory Committee on County Planning, Planning Survey--A Report of Progress, June 1, 1934 to April 15, 1936 (Westchester County, New York, 1936).

to 1933 there were only two or three examples of state-wide planning to be found in the country. Today, thirty-nine states have made such planning a permanent function of government, and in all of the remaining states, except Delaware, Kentucky, and Maine, planning is going forward on a temporary basis, pending the establishment of permanent planning boards by the legislatures. This rapid spread of state planning throughout the country is largely explained by the pressing need for public works programming which developed out of the serious unemployment situation of the depression. Invaluable aid in the formation and operation of the boards has, moreover, been constantly forthcoming through the delegation to each board, by the National Resources Committee, of an expert planning consultant. These consultants have continued to be responsible to the Resources Committee to which body they periodically submit reports of the planning progress made by their respective boards.

The immediate objectives of the boards may vary widely from state to state, but they all have as their ultimate goal the formulation of "master plans" for the prudent exploitation and development of the state resources. To this end, the principal energies of the new boards were all at first directed toward the compilation of state inventories and the orderly presentation of facts and figures, supplemented by maps and charts, respecting the physical and human resources of each state and the use made of them. Most of the boards have by now completed these preliminary tasks, and nearly all have now formulated a six-year program of desirable public works,[6] aiming to replace existing maladjustments by improved material and social patterns.

Another major activity of the state planning boards consists in lending aid to local planning organizations in the accomplishments of such tasks as the development of adequate legal and technical bases for zoning, highway planning, and the like. Finally, the boards are frequently called upon by the state governments and the National Resources Committee for special research service in the prosecution of a large variety of studies.

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[6]See National Resources Committee, Public Works Planning (Washington: Government Printing Office, December 1936). Pp. 221. The six-year public works program elaborated in this report was presented by the President to Congress, on February 3, 1937.

These many-sided and very comprehensive activities of the state planning boards have their visible counterpart in the production of a large output of planning reports, maps and charts. Two supplementary monographs have been issued by the National Resources Committee, which describe the nature, functions, and accomplishments of these boards, and include a list of their reports. The first of these is in the form of a composite summary of the preliminary progress reports issued by some thirty-five state planning boards;[7] the second is made up of individual summaries of the accomplishments realized by each board, including its map productions and pending mapping projects.[8] It is also of interest to note that the large and growing output of planning maps emphasized so strongly the long-felt want of a reasonable standardization of map symbols that the National Resources Committee felt persuaded to compile, first, a preliminary edition of Suggested Symbols for Plans, Maps and Charts (January 1936), and then to follow this up with the publication of a more definitive edition. The latter is also to be printed in the bulletin series of the United States Geological Survey.

(3) Regional Planning Organizations[9]

Regional planning is concerned with planning problems which are common to two or more territorial jurisdictions. Four types of planning may be distinguished under this heading: (a) Intrastate regional planning in Tennessee; (b) Metropolitan regional planning; (c) Interstate regional planning, and (d) the Federal planning of the Tennessee Valley Authority. A brief description of these follows.

(a) Intrastate regional planning was first introduced in the state of Tennessee. It is a type of planning which follows

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[7]See National Resources Committee, State Planning: A Review of Activities and Progress (Washington Government Printing Office, June 1935). Pp. 310.

[8]See National Resources Committee, State Planning Progress and Accomplishments (Washington: Government Printing Office, January 1937). Pp. 128

[9]See National Resources Committee, Regional Factors in National Planning and Development (Washington: Government Printing Office, December 1935). Pp. 223. The book is supplemented by an appendix containing one hundred and eight sketch maps depicting the Federal administrative regions.

more or less conventional metropolitan lines and might perhaps be more aptly designated as "sub-regional" planning. However, the Tennessee State Planning Commission, which has statutory power to set up and delimit the areas selected for this planning, explains its application of the term "region" as follows: "A region may be an urban area surrounding the corporate limits of a city, as in the case of the Nashville Regional Planning Commission, or it may be an entire county, such as that of the Hamilton and Shelby County Commissions, or it may be a group of counties, such as the five-county area of the Northeastern Tennessee Regional Planning Commission."[10] All these "regions," are especially favorable to localized planning of this nature, because of the concentration within them of commercial, industrial, and agricultural interests. Zoning and highway planning are at present the chief tasks of the commissions; the results will eventually be incorporated in the general state plan which is being evolved by the state planning commission. Additional information concerning this type of planning may be found on pages 27-30 of the planning report noted in the last footnote, and also in the 1936 edition of the American Yearbook, page 180.

(b) Metropolitan regional planning is geographically identified with the metropolitan-urban and suburban areas of certain cities. These areas are not identical, however, with the territory which may be considered "tributary" to these cities, for the latter is, as a rule, much larger. The most auspicious earlier example of this type of planning, it may be recalled, is the "Regional Plan of New York and its Environs," which was evolved under the auspices of the Russell Sage Foundation, between 1922 and 1929. The crowning feature of this great undertaking was a map of the New York region, on the scale of 1:62,500, showing, by means of overprint colors, existing and proposed utilization and development of the natural and cultural resources of the region. Today, similar planning activities center about the following seven cities: Chicago, Kansas City, Los Angeles, New York, Philadelphia, St. Louis,[11] and Washington. In all of these cases

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[10] Tennessee State Planning Commission, Planning in Tennessee. Bulletin No. 7 (Nashville; May, 1937). Pp. 32. A list of reports, studies and other publications issued by the commission is appended to this bulletin.

[11] See National Resources Committee, Regional Planning, Part II: St. Louis Region (Washington: Government Printing Office, June, 1936). Pp. 68.

the distinctly regional problems, and hence the regional areas, overlap state boundaries. The New York, Philadelphia, and Chicago regions, for example, extend respectively into three states.

(c) Interstate regional planning is preoccupied with planning problems which require for their equitable solution the coordinated action of groups of states. Indeed, without such coordination it would be practically impossible to obtain satisfactory solutions of the planning problems which are common, for instance, to each of the following interstate regions: the Columbia, the Colorado, and the Delaware River basins, the Great Plains of the West,[12] the fertile corn belt of the Middle West, and the Pacific Northwest.[13]

Two great organizations in the country are directly interested in the establishment and furtherance of interstate planning. One of these is the Council of State Governments, with headquarters in Chicago, and the other is the Federal Government's National Resources Committee, at Washington. Both are equally concerned with state action and interstate cooperation.

The first of these, the Council of State Governments, was created in 1933 by the joint action of certain state legislatures, mostly located in the East. But while the Council is most active in promoting interstate cooperation among the Atlantic seaboard states, its efforts are by no means confined to that region, for they extend as far west as Colorado. The avowed aim of the Council is to secure general interstate action through a completely decentralized structure rather than a centralized one. To this end the Council is much occupied with the calling of conferences of state officials and with the organization of commissions on interstate cooperation. Staff assistance is given to these commissions through regional secretaries, supplied and directed by

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[12] See U.S. Great Plains Committee, The Future of the Great Plains, a report by . . . . (Washington: Government Printing Office, December, 1936). Pp. 194.

[13] In his message to Congress of June 3, 1937, the President recommended the establishment of eight regional authorities, to be identified, respectively, with the drainage basins of: (1) The Atlantic seaboard; (2) the Great Lakes and the Ohio Valley; (3) the Tennessee and Cumberland rivers; (4) the Missouri River and the Red River of the north; (5) the Arkansas, Red and Rio Grande rivers; (6) the Colorado River and rivers flowing into the Pacific south of the California-Oregon line; (7) the Columbia River; and (8) the Lower Mississippi River.

the Council's central secretariat at Chicago. The Council also cooperates, wherever possible, with the National Resources Committee and all the other public planning organizations.

The response of the states to the organizing efforts of the Council has been an increasingly favorable one, as is well attested by the establishment, to date, of some thirty-five permanent commissions on interstate cooperation--all organized by the Council. As an example of a particularly successful regional commission set up by the Council may be mentioned its Interstate Commission on the Delaware River. A more recent attempt of this same nature is the Council's Interstate Commission on the Ohio River Basin.

The National Resources Committee, with its non-partisan state planning boards, also is firmly committed to a policy of decentralized planning and initiative, combined with a minimum of centralized supervision. It is in this sense that the Resources Committee has divided the country into eleven regional planning districts and has appointed a chairman for each. The broad aim behind the creation of the districts is the production of coordinated plans, based, as far as possible, on the studies of the state planning boards within each district. In three of the districts--New England, Ohio Valley, and Pacific Northwest--special regional planning organizations have been established through the efforts of the district chairmen. In other districts group meetings or personal contacts effect whatever coordination or measures the National Resources Committee desires to suggest to public officials.

Outstanding examples of the type of regional planning sponsored by the National Resources Committee are the New England Regional Planning Board,[14] and the Pacific Northwest Regional Planning Board.[15] The former covers the six traditional New England states, and the latter the states of Idaho, Montana, Oregon, and Washington. The activities of these boards are

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[14]See National Resources Committee, Regional Planning, Part III: New England (Washington: Government Printing Office, July, 1936). Pp. 101. See also, New England's Prospect: 1933 (New York: American Geographical Society, 1933), edited by John K. Wright, the librarian of the society.

[15]See National Resources Committee, Regional Planning, Part I: Pacific Northwest (Washington: Government Printing Office, May, 1936). Pp. 192.

strictly confined to physical planning and to a few problems relating to state and administrative organization. Other regional planning boards and commissions set up by the National Resources Committee are the Georgia East Coast Planning Commission, and the Ohio Valley Regional Planning Commission. Brief references to the maps and mapping activities of these regional planning boards are included in the monograph listed in footnote 8.

(d) The Tennessee Valley Authority occupies a rather unique place among the public planning organizations.[16] Its status is that of an independent Federal planning and operating agency, charged with the navigational and economic development of the Tennessee watershed--a region of some forty thousand square miles, extending into seven states. This vast and multifarious undertaking has necessarily been productive of much valuable map material.[17] We note as one particular item the sectional Atlas of the Tennessee Valley Region, which is presently being prepared by the Division of Land Planning and Housing of the Tennessee Valley Authority. Two sections of the atlas dealing, respectively, with land and climatic elements, and with industrial development, have already been released.[18] Subsequent sections are to be devoted to land-use items, land value, farm income, and population.

Much credit is also due to the staff geographers of the Valley Authority for their elaboration and application of methods of land classification. By these methods the land in the Valley has been roughly grouped into five classes as determined on the basis of physical conditions and economic land use factors. The results have been expressed, numerically in the form of fractional

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[16] See National Resources Committee, Regional Factors . . . ., op. cit., pp. 85-116. For more current data regarding the activities of the Tennessee Valley Authority, inquiry should be directed to its Information Division, at Knoxville, Tennessee.

[17] A mimeographed list of maps and charts relating to the Tennessee Valley Region and, in particular, to the individual engineering projects executed there by the Tennessee Valley Authority, has been issued by the Engineering Service Division of the Valley Authority, under the title of List of Maps and Data in Central Map Files. The list is dated January 1, 1935, and may be obtainable from the Information Division, at Knoxville.

[18] Both sections were issued in June, 1936, by the Land Classification Section, Division of Land Planning and Housing, The Tennessee Valley Authority. The first section is entitled, Part I: The Natural Series; the second is called, Part II: The Industrial Series.

indices, and graphically upon an air-photograph mosaic on the scale of 1:24,000.

It should also be noted that the entire Tennessee River Basin is now covered by 758 planimetric maps without contour lines, on the scale of 1:24,000. There are also available a variety of base maps covering the entire Basin and specific areas where dam and reservoir operations are in progress or contemplated. Reference is finally made to the general treatise on planning in the southern states, which Professor Howard W. Odum has contributed under the title of The Southern Regions in the United States. The book, published by the University of North Carolina Press, is supplemented by over three hundred maps and charts.

### (4) The National Resources Committee[19]

Cooperation with planning organizations throughout the country--frequently alluded to in the preceding pages--constitutes by no means the sole function and raison d'être of the National Resources Committee. Indeed, the President's executive order of June 7, 1935, defining the functions and duties of the committee, also enjoins it: "To collect, prepare and make available to the President, with recommendations, such plans, data and information as may be helpful to a planned development and use of land, water, and other national resources, and such related subjects as may be referred to it by the President."[20]

It should be noted, however, that the National Resources Committee does not itself engage in original research work or elaborate fact-finding, for its functions are primarily of an advisory nature. These frequently very formidable and highly specialized tasks the committee assigns to technical subcommittees, the personnel of which it selects from among government officials and competent outsiders. A central administrative office is maintained in Washington for the purpose of coordinating the activities of the Resources Committee and its various technical subcommittees, staff sections, and field organizations.

The results already achieved under this arrangement must undoubtedly rank as the most comprehensive and substantial contributions which have yet been made toward an intelligent

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[19] See National Resources Committee, Progress Report with Statements of Coordinating Committees (Washington: Government Printing Office, June 15, 1936). Pp. 61.

[20] Ibid., p. 24.

appraisal of the nation's physical and human resources, their distribution, utilization, and multiple regional interrelations. A very considerable portion of these contributions is in the form of reports. They range in subject-matter from summary accounts of the activities and accomplishments of state and regional planning boards, to detailed expositions of maladjustments in the use of land, water, and mineral resources, with specific recommendations for their systematic correction. Among the more outstanding recent reports prepared under the aegis of the Resources Committee may be mentioned its national water resources report, based on the study of seventeen of the country's major drainage basins,[21] and its report on the social implications of technological changes.[22] An analytical list of the reports and studies issued by the National Resources Committee and its predecessors, up to June, 1936, may be found on pages 53-61 of the progress report noted in footnote 19. The several reports of the committee which have been published during the year since that list was compiled, have all been cited in these pages.

Historically, the National Resources Committee is the successor to the National Resources Board and, beyond this, to the National Planning Board set up by the Federal Administrator of Public Works in July, 1933.[23] As previously noted, the committee functions by virtue of an executive order of the President, dated June 7, 1935. Its membership is made up of six government officials, including the Secretary of the Interior as chairman, and of two non-official members. The latter are also members of the all-important steering or Advisory Committee, which closely cooperates with the chairman of the Resources Committee in preparing reports and recommendations for action.

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[21]See National Resources Committee, Drainage Basins Problems and Programs (Washington: Government Printing Office, 1937). Pp. 540.

[22]See National Resources Committee, Technological Trends and National Policy, including the Social Implications of New Inventions (Washington: Government Printing Office, June, 1937). Pp. 338.

[23]See National Planning Board, Final Report, 1933-34 (Washington: Government Printing Office, November 16, 1934). Pp. 123. This valuable, first report on national planning includes synoptic lists of the Federal agencies engaged in planning; see pages 75-84.

That the temporary status of the National Resources Committee may eventually be changed into a permanent one, is plainly foreshadowed in the epochal report on government reorganization, which the President presented to Congress on January 12, 1937.[24] In this report, and again in the President's message to Congress of February 3, 1937, it is strongly urged that "a permanent National Resources Board be set up to replace the present temporary committee." In view of the invaluable and increasingly indispensable public service a strictly non-partisan national planning board is demonstrably capable of rendering, one can but profoundly hope that such a body be soon made a definite and permanent adjunct of the office of the President.

In closing this rapid sketch, attention is briefly directed to the existence of a group of organizations and institutions, other than those we have dealt with, which are interested in public planning and are supporting it. We note particularly The American Society of Planning Officials, and the other national governmental organizations which are housed at 1313 East Sixtieth Street, Chicago; the American City Planning Institute, and the American Planning and Civic Association. The latter organization represents citizen groups; the American City Planning Institute is a professional society. All of these bodies focus attention on problems which form the subject of study by the public planning agencies we have dealt with. Many of these studies, it may be recalled, are concerned with geographical distribution and are, therefore, important sources of map material.

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Katherine McNamara, Bibliography of Planning: 1928-1935 . . . (Cambridge: Harvard University Press, 1936). Pp. 232.

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[24] President's Committee on Administrative Management, Administrative Management in the Government of the United States (Washington: Government Office, January 8, 1937). Pp. 47. The members of this committee were, Louis Brownlow, chairman, Charles E. Merriam, and Luther Gulick. Thanks are due to Professor Merriam for the gift of an early copy of the report.

Arkansas State Planning Board, "Compendium of Maps and Charts; Progress Report" (Little Rock?: State Planning Board, 1937 [Processed]). Pp. 60.

Albert S. Fry, "The Tennessee Valley Mapping Program," News-Notes, American Society of Photogrammetry, II, No. 3 (July-September, 1936), 4-7.

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Maryland State Planning Commission, "First Report of the Maryland Mapping Agency . . . . Sponsored jointly by the Maryland State Planning Commission and the University of Maryland . . . . " (Annapolis?: State Planning Commission, 1936 [Processed]). Pp. 25.

Michigan State Planning Commission, "Publication No. 3. Maps and Statements. Natural Resources Areas. Physical Development Projects, Local Planning and Zoning" (Lansing: State Planning Commission, October, 1936 [Processed]). Pp. 13.

National Resources Committee, "Bibliography of Reports by State and Regional Planning Organizations received in the library of the National Resources Committee, January-April, 1937, supplementary to State Planning, Programs and Accomplishments, December, 1936" (Washington: National Resources Committee, 1937 [Processed]). Pp. 14. An additional list has been issued for May and June, 1937. These lists supplement the bibliography contained in the progress report cited in footnote 8, page 316, preceding.

Oklahoma State Planning Board, "A Compendium of Maps and Charts Pertaining to State Planning in Oklahoma" (Oklahoma City: State Planning Board, 1936 [Processed]). Pp. 132.

Oregon State Planning Board, "Mapping Program for Oregon, Status of topographic and aerial mapping with recommendations for completion. A report from the Advisory Committee on Aerial Surveys and Maps to the State Planning Board" (Portland: State Planning Board, 1937 [Processed]). Pp. 21.

Utah State Planning Board, "Index of Maps" (Salt Lake City: State Planning Board, 1936 [Processed]). Pp. 16.

# A P P E N D I X  V

## LIST OF INTERNATIONAL MAPS

### 1. World Maps

Aeronautical Map, International General, 1:3,708,758 (on equator) (Carte Générale Aéronautique Internationale)

(1920-33. Only about 19 sheets--8 by Great Britain, 10 by France, 1 by Poland--have been published of this map which is now discontinued. Each sheet covers 18° of longitude by 12° of latitude, comprising 9 sheets of the international map of the world on the millionth scale. The map is on the Mercator projection with the curious scale of 3 cm. to 1° of longitude on the equator. Owing to variation of scale with change of latitude, the scale of miles must be redrawn for each 2 degrees, so that the scale of approximately 1:3,700,000 on the equator becomes 1:2,000,000 in latitude 54°, which is at the middle of the sheet for Great Britain. The sheets are in color with relief shown by a few layer tints and by spot heights. Much aeronautical information is shown in black. No separate list or index chart is available which covers all the published map sheets. The French sheets have been produced by the Service Géographique de l'Armée, Paris, and are noted in its catalogue. Information regarding the sheets of other countries may be obtained from the Central Bureau, Ordnance Survey, Southampton, England.)

Bathymetric Chart of the Oceans, General, 1:1,000,000 (Carte Générale Bathymétrique des Océans)

(A third edition of the chart has been in progress since 1935. The complete chart will consist of 24 sheets, in color, 3 of which had been published by August, 1937. Each sheet measures approximately 101 by 75 cm. The price of the chart is about Frs. 840. The producer and distributor is the International Hydrographic Bureau at Monaco. Its 4-page price list with key index chart, entitled List of Publications of the International Hydrographic Bureau, is obtainable free.)

Geological Map of the World, International, 1:5,000,000 (Carte Géologique Internationale de la Terre)

(Publication of the map was commenced in 1932; at least 4 of the 80 sheets required to complete the map had been published by 1937. The map is sponsored by the International Geological Congress and is being produced and distributed by the Preussische Geologische Landesanstalt, Berlin.)

Geological Map of the World 1:15,000,000 (Geologische Karte der Erde)

(1929-32. The map is complete in 12 colored sheets, each measuring 80 by 64 cm. On stereoscopic projection. Produced

by Professor Franz Beyschlag with cooperation of the Preussische Geologische Landesanstalt, Berlin. Obtainable from Gebrüder Borntraeger, Berlin, at price of RM. 200.)

Hispanic America, Map of, 1:1,000,000 (see p. 232)

International Map of the World 1:1,000,000 (Carte Internationale du Monde au 1,000,000e)

(In progress. Approximately 1,500 sheets will be required on this scale to cover all the land areas, each sheet representing 4° of latitude and 6° of longitude. The map is being produced by agreement among many nations, each of which contributes and prepares its share of the map according to prescribed and uniform standards. A detailed list with index chart of all the map sheets which have been published is issued annually in the form of a printed report and is obtainable at the price of five shillings from the Central Bureau, Ordnance Survey, Southampton, England. The map sheets may be purchased from C. S. Hammond and Company, 30 Church Street, New York City, and from Edward Stanford, 12-14 Long Acre, W. C. London, England.

Of the United States portion of the map only 4 sheets have thus far been published; they are listed in Price List 53, which is issued by the Superintendent of Documents, Washington, D.C. The sheets may be purchased from the U.S. Geological Survey at 40¢ each. It may be noted that as a preliminary to the issuance of the completed color sections of the map, the Geological Survey has printed state maps on the scale of 1:500,000, or four times the size of the millionth scale maps. Most of these sell for 25¢ a copy or 15¢ in lots of 20 or more. Many state maps are available also on the scale of 1:1,000,000, priced at 5¢ each.)

## 2. Maps of Europe

Electric Power Map of Europe 1:1,500,000 (Title reads "Europe. Usines de Production, Réseaux de Transmission d'Energie Electrique")

(1931. The map consists of 6 sheets and shows the distribution of electric generating stations and distribution lines. It is issued by the Conférence Internationale des Grands Réseaux Electriques à Haute Tension, 54 Ave. Marceau, Paris, and associated companies.

It may be added that maps very similar in make-up to the above map have been published, respectively, of France, Paris, and North Africa. All depict the "Production, Transport et Distribution de l'Energie Electrique" (Production, transmission and distribution of electric power). The map of France is on the scale of 1:625,000, consists of 4 sheets, and is dated 1934. It is supplemented by a detailed power map of Paris on the scale of 1:100,000, a ninth edition of which was issued in January, 1937. The map of North Africa is made up of 2 sheets, is scaled 1:1,000,000, and dated 1931. All three maps were published by the Société Financière Electrique, Paris.

In the United States similar power maps have been published by the Federal Power Commission, as noted elsewhere. More recently the State Electrification Committee of Illinois has

locally supplemented these maps by issuing a lithographed map on the scale of 1:500,000, entitled Map of Electric Transmission and Distribution Lines in Illinois. It is colored, measures 50 by 30 inches, was published in 1937, and is obtainable at the price of $1 from the State Committee at Springfield.

Geological Map of Europe, International, 1:1,500,000

(Publication of the second edition of the map has been in progress since 1932. It will comprise 49 sheets, inclusive of title page and legend sheet. Perhaps 8 sheets had been issued by 1937. The map is sponsored by the International Geological Congress and is produced and distributed by the Preussische Geologische Landesanstalt, Berlin. The editor is W. Schriel. The price of the sheet is RM. 36. The first edition of the map was published from 1881 to 1913; it was produced under the editorial direction of Franz Beyschlag and distributed by Dietrich Reimer of Berlin.)

Railroad Map of Europe 1:1,500,000 (Carte des Chemins de Fer d'Europe)

(1932. Complete in 6 sheets measuring, when joined, 242 by 206 cm. Nine colors are used to distinguish the railroads of the different countries. The map is supplemented by an Index booklet of 48 pages, listing the 9,600 place names shown on the map, and by an Atlas of 11 maps depicting on larger scales and in more detailed areas of greatest traffic density and other special significance. Map, index, and atlas may be purchased from the Secretary of the Union International des Chemins de Fer, Paris, or from Messrs. Girard & Barrère, 17 rue de l'Ancienne Comédie, Paris, at the price of Frs. 120.)

Soil Map of Europe, International, 1:2,500,000 (Internationale Bodenkarte von Europa)

(1925-37. The map is complete in 12 colored sheets which measure, when placed end to end, 240 by 220 cm. This is the first map of its kind based on actual surveys of the areas covered. The map was produced under the sponsorship of the International Society of Soil Science and the editorial direction of Dr. Hermann Stremme of Danzig. It is published by the Gea Verlag, Berlin, at the price of about $48.)

## 3. Map of Roman Empire

Roman Empire, International Map of the, 1:1,000,000 (Carte Internationale de l'Empire Romain)

(The map is being produced by agreement among a certain number of nations--Great Britain, France, Italy, Egypt--each of which contributes and distributes its share of this historical map. Approximately 8 sheets had appeared by 1937. No separate list for them is available. Information respecting the status of the map may be obtained, however, from the Central Bureau, Ordnance Survey, Southampton, England. The sheets may be purchased from the International Map Company, from C. D. Hammond and Company, both of New York City, and from Edward Stanford, 12-14 Long Acre, W. C. London, England.)

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Admiralty charts and catalogue (Great Britain), 257
Advisory Committee on Geographic Names, U.S., 173
Aerial photography in the United States, Status of (map), xiv, 220
Aerial surveying and mapping (U.S.), xiii-xiv, 141
See also Planimetric mapping
Aeronautical charts
Canada, 224
Great Britain, 248, 249
International, 339
United States
Aviation charts (Hydrographic Office), 153, 190
Planning chart (Coast and Geodetic Survey), 181
Regional charts (Coast and Geodetic Survey), 133, 181
Sectional charts (Coast and Geodetic Survey), 131-33, 181
Strip airway maps (Army Air Corps), 170, 201
Aeronautics Bureau, U.S., 160
Africa
British Crown Colonies, maps, see G.S.G.S. catalogue
French West Africa, maps, see catalog listed on p. 50
Agnese, Battista, maps, 71, 75
Agricultural Economics Bureau, U.S., 166, 176-77
Agricultural Engineering Bureau, U.S., 167
Agriculture, Atlas of American, 175
Agriculture (U.S.), outlook charts, 177
Ailly, Pierre d'
Imago Mundi, 23, 25
Air Commerce Bureau, U.S., 167
Air mail map, Domestic (U.S.), 191
Airway maps, see Aeronautical charts
Alaska
Astronomic stations, maps, 181
Base map, outline, 182
Boundary maps, 193
Topographic mapping, 124, 126
Alberta (Canada)
Geologic maps (Research Council of Alberta), 227
Various maps, 226
Albi mappe monde, 12
Alexandria, Va.: Port Series No. 16, 204
Alluvial Valley, Lower Mississippi River, mapping, 165, 211
Altamaha River, charts, 205
American Geographical Society, 232, 234, 283, 289
Animal diseases (U.S.), maps showing distribution, 234
Animal Industry Bureau, U.S., 177
Anville, Jean Baptiste B. d'
Maps and atlases, 42-43, 94
Apian, Philip, 28
Appalachian Region, Southern, power map, 323
Appalachians, Southern, maps of, 167
Argentina, official mapping, 233
Arkansas River, charts, 212
Arkansas State Planning Board "Compendium of Maps," 338
Armenia-Turkey, boundary map, 197
Army Engineers, U.S., see Corps of Engineers, U.S. Army
Arrowsmith, Aaron
Map of North America, 99
Aruba (West Indies), maps, 241
Asia, map (1:4,000,000), 257
Astoria, Ore.: Port Series No. 11, 217
Atlas Catalan, 20
Atlas of American Agriculture, 175
Atlas of Federal-aid highway systems (U.S.), 179
Atlas of New Jersey (topographic), 323
Atlas of the Historical Geography of the United States, 81
Atlas of the Tennessee Valley Region, 334
Atlas of the United States, Scribner (1880), 180
Atlas of the United States, Statistical (Census Bureau), 180

Atlases, early, United States, 105
Austria
  Official maps and catalog, 274-75
Aviation charts, see Aeronautical charts

Baden (Germany)
  Official maps and catalog, 267, 271
Baltimore, Md.: Port Series No. 16, 204
Base maps (U.S.), of
  Counties, 322
  States (individual), 124, 322, 326
  United States (whole area), by
    Coast and Geodetic Survey (scales: 1:5,000,000; 1:5,094,000; 1:7,500,000), 200
    General Land Office (scale 37 mi. to 1 in.), 184
    Geological Survey (maps on various scales), 220
  World (U.S. Hydrographic Office), 190
  See also Outline maps
Bathymetric chart of the oceans, 339
Bavaria (Germany)
  Official maps and catalog, 267, 271, 273
Beatus maps, 12
Behaim globe, 25
Belgium
  Carte Chorographique, 46
Bellin, Jacques Nicolas, 94
Bemis, S. F. and Griffin, G. G.
  Guide to Diplomatic History, 193
Bergen (Norway), map of environs, 281
Bering, Vitus, 69
Berlin, map of environs, 261, 269
Bibliography and Index of Geology Exclusive of North America, 314
Bibliography of North American Geology, 186
Blaeu, Willem J., 30-31
Blaeu atlases, 30, 31, 53, 54
Board of Rivers and Harbors, U.S., 202
Board of Surveys and Maps (U.S.), see Federal Board of Surveys and Maps
Boggs, S. W., on map classification, x, 286, 287, 291, 295
Bolivia, mapping, 234
Bonaire (West Indies), maps, 241
Bonne, Chevalier, 46
Bonneville, Captain, 110
Boston, Massachusetts: Port Series No. 2, 202
Boulder Dam
  Project maps and topographic surveys, 144, 151, 189
Boundary maps
  Alaska and Canada, 223
  British Borneo and Philippine Islands, 199
  Canada, 223
  Turkey and Armenia, 197
  United States, Alaska, and Canada, 193-94, 200
  United States and Mexico, 194-97, 199, 200
  See also International Boundary Commissions
Bradley, Abraham, Jr., map of United States post roads (1796), 156
Brazil, official mapping, 234
British Columbia, maps, 227-28
British Territories, list of maps, see G.S.G.S. catalogue
Brunswick, Ga.
  Harbor charts, 205
  Port Series No. 10, 206
Bry, Theodore de
  Map of Florida, 82
Buache, Phillippe, 93
Bucher, Walter H.
  Catalogue of geologic maps, 314
Budapest, city map (1:15,000), 277
Buell, Abel, map of United States (1784), 105
Buenos Aires, maps, 233
Buffalo, Port of: Lake Series No. 1, 208
Busius, Bernard, 29

Cabot, John, voyages to North America, 63
Cabot, Sebastian
  Voyages to North America, 63
  World map, 78
Cadastral maps and mapping
  France, 49
  Germany, 259
  Great Britain, 253
  United States, by
    Forest Service, U.S., 141
    General Land Office, U.S., 148, 149

California
Early explorations and maps, 61, 102, 103
Official map, 323
Camden, N.J.: Port Series No. 4, 203
Canada
Dominion government mapping services and maps
Geographic Board, 223
Geographical Section, General Staff, 221
Geological Survey, 225
Hydrographic Service, 225-26
Marine and Fisheries Department, 226
Topographical and Air Survey Bureau, 221-25, 228, 231
Provincial mapping services
Alberta, 226-27
British Columbia, 227-28
Manitoba, 228
New Brunswick, 228
Nova Scotia, 228
Ontario, 229
Prince Edward Island, 229
Quebec, 229-30
Saskatchewan, 230-31
Territories, 228, 231
Cantino planisphere, 66
Capitaine, Louis, 46
Carey, Mathew, first American atlases by, 105
Caribbean Sea, pilot charts, 153
Carignano, G., 19
Carte de France (1694), 40
Carte de l'Etat Major, and derivative maps, 47, 48
Carte générale de la France, 44
Carte Pisane, 19
Cartier, Jacques, exploration and mapping of St. Lawrence region, 75, 76-81
Cartographic summary of Tennessee Valley region, 338
Cary, John, atlases, road maps, 46, 52, 56, 57
Cassini, Jean Dominique, 36, 40, 41, 44
Cassini de Thury, Jacques, 39
Cassini map of France and derivative maps, 44-46, 50
"Castiglioni map," 73
Castillo map of California, 61, 78
Cataloging of map collections, see Map cataloging systems
Catalogus Auctorum (Ortelius), 29
Cattle tick-fever map (U.S.), 177
Census Bureau, U.S., 168, 180-81
Central America, maps, 219, 232, 235
Central Europe, maps, 258, 259, 263, 264, 275
Central Mexico, map (Ortelius), 83
Champlain, Sieur Samuel de
Exploration and mapping by, 85, 88, 89
Channel Islands (Great Britain), maps, 240
Charleston, S.C.: Port Series No. 9, 204
Charts (coastal, nautical, navigational)
Canada, 225-26
Great Britain, 257
International
Bathymetric chart of the oceans, 339
United States
Domestic coasts and inland waterways, 129-30, 182
Foreign coasts and waters, 153, 190
Great Lakes, 134-36, 208
Harbors, 130, 182
See also Lake Series, and Port Series reports, under names of port cities
Intracoastal waterways, 130, 182
New York State canals, 203
Pilot charts of oceans, 153
River charts and systems, xi, xii, 158-60, 161-66
See also under names of rivers
Sailing charts, 131, 182
Tidal current charts, 131, 182
Chaves-Santa Cruz group of maps, 73-74, 77
Chemistry and Soils Bureau, U.S., 138, 178
Chesapeake Bay, current diagram (large scale), 131
Chicago, Port of: Lake Series No. 4, 208
Chicago River charts, see Illinois waterway system
Chile, official mapping, 235
China, maps, 197, 198, 266
City maps and plats (U.S.), sources of, xii
City planning boards (U.S.), 327
Civil divisions, minor (U.S.), maps of, 180, 325

Cleveland, Port of: Lake Series No. 5, 208
Climate maps (U.S.), 175
Coal fields of United States, map (scale 37 mi. to 1 in.), 220
Coal producing districts (U.S.), maps of
States (individual), 326
United States, 220
Coast and Geodetic Survey, U.S., 127-34, 181-82, 220, 325
Colles, Christopher, early road map of United States, 105, 156
Collot, Victor, Mississippi River map (1796), 163
Colombia, official mapping, 236
Colonial system, European and New World, maps, 201
Colorado and Columbia rivers, irrigation projects, 151
Colorado River....boundary map, 196
Columbus, Christopher, 23, 24
Communication charts, of
Atlantic ocean, 219
Mexico, 219
United States (Amateur radio call areas), 183
World (by U.S. Hydrographic Office), 190
Congressional districts (U.S.), maps, 183
Cook, Captain James
Northwest coast survey, 100
Coppo, Pietro, earliest engraved map of Britain, 51
Corps of Engineers, U.S. Army
Description of mapping activities, 158-66
Division and district offices and their chart productions
Great Lakes Division, 208
Gulf Mexico Division
District offices
Galveston, Texas, 209
Mobile, Ala., 209
New Orleans, La., 209
Lower Mississippi Valley Division, 210
District offices
Memphis, Tenn., 212
Vicksburg, Miss., 212
Mississippi River Commission, 164-66, 210-11
Missouri River Division, 214
District offices
Fort Peck, Mont., 214
Kansas City, Mo., 214
Omaha, Nebr., 214
Corps of Engineers, U.S. Army
Division and district offices and their chart productions (Cont.)
North Atlantic Division
District offices
Boston, Mass., 202
Eastport, Me., 202
New York (First and second districts), 202
Philadelphia, Pa., 203
Providence, R.I., 202
Puerto Rico, 203
North Pacific Division, 216
District offices
Portland, Ore., 217
Seattle, Wash., 217
Ohio River Division, 215
District offices
Cincinnati, O., 215
Huntington, W. Va., 215
Louisville, Ky., 216
Nashville, Tenn., 216
Pittsburgh, Pa., 216
Zanesville, O., 216
South Atlantic Division, 204
District offices
Baltimore, Md., 204
Charleston, S.C., 204
Jacksonville, Fla., 204
Savannah, Ga., 205
Washington, D.C., 207
South Pacific Division, 217
District offices
Honolulu, Hawaii, 219
Los Angeles, Calif., 218
Sacramento, Calif., 218
San Francisco, Calif., 218
Upper Mississippi Valley Division, 212
District offices
Chicago, Ill., 213
Rock Island, Ill., 213
St. Louis, Mo., 213
St. Paul, Minn., 213
Cortereal brothers, 66
Cortes, Hernando, 61
Cosa map, see La Cosa
Cosmas, Indicopleustes, 11
Council of State Governments (U.S.), 332, 337
Counties (U.S.), number of, in each state, 322
County maps (individual counties)
England and Wales, 52, 53, 55, 253
Great Britain, 248
United States, maps by
County governments, 324

County maps (individual counties)
United States, maps by (Cont.)
Federal government
Rural delivery maps, 191
Soil maps, 178
State governments
Base maps, 322
Highway maps, 321-23
Postal route maps, 322
See also Public planning organizations
County outline maps of United States, 176
See also Base maps; Outline maps
County planning commissions (U.S.), 327
Crawford, Lord
Bibliotheca Lindesiana, 77
Crown collection of photographs, 95
Cuba, maps, 219, 240
Curacao (West Indies), maps, 241
Current diagrams and charts (U.S.), 130

Dalorto, Angelino, portolan chart (1325), 20
Danube, Middle and lower, map, 277
Delamarche, Charles F., map of United States (1785), 95
Delaware Territory, maps, 96
Delisle, Guillaume, maps and atlas publications, 40, 41-42, 93
Denmark, list of official map publications, see Eisenschmidt catalog
Desceliers, Pierre, 76, 77, 78
Desliens, Nicolas, 76-77
De Soto, see Soto, Hernando de
Detroit, Port of: Lake Series No. 2, 208
Dieppe school of cartographers, 76, 77-78
District maps
England and Wales, 247, 248
Germany, 262
Dominican Republic, maps, 240
Duluth-Superior, Port of: Lake Series No. 6, 208
Dutch charts of Atlantic coast, early, 96

Earth measurements, scientific, 38, 40
Ebstorf map, 14, 16
Ecuador, maps, 237
Eisenschmidt catalog, 267
Electric power maps, of
Europe, 340
France, 340
North Africa, 340
Paris, 340
United States
States (individual), 323, 326
United States, 147, 183
England
Historical maps, 16, 30, 51-56, 250
Outline maps, 250
Physical map, 250
See also Great Britain
Eratosthenes, 4-5, 6
Erosion survey maps (by U.S. Soil Erosion Service), 145, 180, 326
Erskine, Robert, early road maps of United States, 104
Escalante, Silvestre Velez de, 103
Europe (whole area), maps
Electric power map, 340
Geologic map, 341
Railroad map, 341
Soil map, 341
European colonial system, maps, 201
Evans, Lewis, map of British colonies (1755), 98

Farm land....in United States, value per acre, map, 177
Farm unit plats (U.S.), 189
Farming areas of United States, map showing types of, 177
Federal-aid highway system (U.S.)
Atlas of United States, 179
Progress maps (of individual states), 142, 172
Federal Board of Surveys and Maps, U.S., xiv, 171, 220
Federal Communication Commission, U.S., 183
Federal Power Commission, U.S., 145-47, 183
Fernandina Harbor, Fla., charts, 205
Ferraris, Comte Joseph de, 46
Fire control maps (U.S. Forest Service), 141
Fire insurance maps (Sanborn Map Company, U.S.), xii
Florida, map (1819), 198
Foreign and Domestic Commerce Bureau, U.S., 168
Foreign service posts, map (U.S. State Department), 201
Forest Service, U.S., 141, 178

Forests, national, maps
Canada, 223
United States, 141, 178
France
Cadastral map, 49
Carte de l'Etat Major, 46, 47
Cassini map of France, 43 45-46
Catalog of maps, official, 50
French West Africa, list of maps, see catalog cited on p. 50
Topographic map (1:50,000), 49
Franquelin, Jean B. L., maps of North America, 92
Fremont, Captain John C., 111
Frost and growing season (U.S.), maps, 175

G.S.G.S. (Geographical Section, General Staff. Great Britain)
Map catalogue, 257
Gallatin, Albert, map of Northwest, 109
Galveston, Texas: Port Series No. 6, 209
Ganong, W. F., 72
Gastaldi-Italian group of New World maps, 75
See also footnote 6, p. 29
General Land Office, U.S., 148-50, 183-85
Geodetic control survey index maps (U.S. Coast and Geodetic Survey), 182, 325
Geographic Board
Canada, 223
United States, 173
Geologic folios (U.S.), 125-26, 185
Geologic maps
Argentina, 234
Canada, 225
Alberta, 227
Ontario, 229
Europe, 341
Germany, 272-73
Great Britain, 255
United States
Geologic folios, 125-26, 185
Geologic map of the United States (1:2,500,000), 319
State geologic maps, list of, 315-20
World, 339
Geological surveys
Canada, 225
Ontario, 229
Great Britain, 255
Geological surveys (Cont.)
United States
State geological surveys, 312-14
U.S. Geological Survey, xii, 115, 121-27, 185-86, 220
Geology
Bibliography and index (exclusive of North America), 314
Bibliography of North American geology, 186
World atlas of commercial geology, 186
See also Bucher, Walter H.
Germanus, Dominus N., 22
Germany
National mapping service
Reichsamt für Landesaufnahme, 258, 260, 266-67, 268-71
Provincial mapping services
Baden, 258
Bavaria, 258, 273
Hessen, 258
Prussia, 272
Saxony, 258
Württemberg, 258, 273
Gold Coast (Africa), map list, see G.S.G.S. catalogue
Gomez, Estevan
North American voyage and maps, 72, 73
Grand Coulee Power Dam, 151
Graphic Summary of American Agriculture, 176
Gray, Captain Robert, 101
Great Britain, maps and services
Geographical Section, General Staff, 257
Geological Survey, 255-56
Hydrographic Department, 257
Ordnance Survey, 57, 242-43
Large scale maps, 251-55
Small scale maps, 240, 245-51
Great circle chart of the United States (1:5,094,000), 182
Great Lakes charts, 89, 91, 94 134-36, 208, 226
Great Plains (U.S.), land classification maps, 325
Great London, district maps, 248
Growing season (U.S.), maps, 175
Guam, charts, 182
Guianas (British, Dutch, French) mapping, 237
Gulf of Mexico, charts, 182

Haiti, mapping, 240

Haldingham, Richard of, 14
Hamburg (Germany), map of environs, 261, 270
Handbook of the States (U.S.), 337
Harbor charts (U.S.), 130, 182
See also Lake Series reports; and Port Series reports under names of port cities
Harmon, W. D., 101
Hawaii Territory: Port Series No. 17, 218
Hayden, F. V., 114
Hearne, Samuel, 100
Hennepin, Father Louis, 91
Hereford mappe monde, 14, 16
Hessen (Germany), maps, 267
Highway maps; road maps
Austria, 274
Canada, 228, 229, 230
Germany, 262, 263, 270
Great Britain, 34, 56, 247, 248, 249
United States
County highway maps, 322-23
County, rural delivery maps, 191
Federal-aid highway system
Atlas of United States, 179
Progress maps, 179
Inter-American highway strip maps, 143
National parks maps, 169, 187-88
Post route maps, 155-56, 191, 322
State highway maps, 321-23
Systems of United States highways, map, 179
Transportation maps, 143, 180, 322
Hispanic America, millionth scale map (by American Geographical Society), 232
Historical period maps (Great Britain), 250-51
Homem, Diego, 79
Homem, Lopo, 76, 77
Hondius, Henrick, 29
Hondius-Mercator atlases, 29, 30, 93
Houston, Texas: Port Series No. 6, 209
Hudson Bay Company, exploration in American Northwest, 100
Humidity maps (U.S.), 175
Hungary, official mapping, 276
See also Eisenschmidt catalog
Hydrographic chart publications and catalogs
Canada, 226
Great Britain, 257
United States, 152-54, 190
See also Bathymetric chart
Illinois
State electrification map, 323
Waterway system, charts and chart lists, 213
Imago Mundi (Pierre d'Ailly), 23
Immigration quota area (U.S.), map, 201
Index-circulars, showing progress of geologic and topographic mapping in each state (U.S.), 185, 325
Index maps, showing topographic mapping status in United States, 124, 220
Indian Affairs Office, U.S., 150, 187
Indian reservation maps (U.S.), 150, 187
Inland navigation charts, see charts
Inter-American highway strip maps, 143
Inter-coastal waterway (Jacksonville, Fla.), maps, 204
International boundary commissions
United States, Alaska, and Canada, 136, 193-94
United States and Mexico, 157-58, 194-97
International Map of the World (1:1,000,000), maps by
Brazil, 234
Canada, 224
Germany, 265
Great Britain, 249
United States, 132, 186
See also, Appendix V
Intracoastal waterways (U.S.)
Inside route charts, 130, 182
Navigation charts, 204, 205
Pilots, 130
Ireland, survey by William Petty, 55
Ireland, Northern, note on mapping, 243, 253
Irish Free State, note on mapping, 243, 253
Jacksonville, Fla., district charts, 204, 205

Jacksonville, Miami, Key West, Tampa, and South Boca Grande, Fla.: Port Series No. 8, 205
Jaillot, Alexis Hubert, maps and atlases, 32, 33, 92
Jamaica, Island of, mapping, 240
Jansson, Jan, 29, 30, 54
Jefferson Ordinance of 1784, showing proposed states, 95
Jefferys, Thomas
American Atlas...., 98, 99
Jerome maps, 13
Jesuit map of Lake Superior, 90
Joerg, W. L. G., 124, 139
Joliet, Louis, 86, 90, 91
Jomard, Monuments...., 64
Judaeis, Gerardi de, 30

Karpinski, Louis
Bibliography...., 89
King, Clarence, 114
Kino, Father Eusebio, map of Lower California, 102
Kretchmer, K., Atlas...., 77
Kunstmann, F., Atlas...., 75

Labrador, 74, 80
La Cosa, Juan de, earliest known map showing part of America, 64-66
Laet, Johan de, 96
Lafreri atlas, 82
Lahire, Carte de France, 40
Lake Champlain, charts, 208
Lake of the Woods, charts, 208
Lake Series reports (U.S.), list of, 208
Lake Superior, Jesuit map, 90
Lake Survey charts (U.S.), 134-36, 208
Land classification maps
Canada, Western, 223
United States
Great Plains, 325
Tennessee Valley Region, 334
See also Atlas of American Agriculture
Land relief maps (U.S.), 175
Land-use areas of United States, Map of natural, 176
Land utilization maps
Great Britain, 247
United States, 167
See also Graphic Summary of American Agriculture
La Salle, Robert Cavelier de, 86
Latin America, status of topographic mapping, 232
Laudonnière, René, 82
Laurentian portolano (1531), 20
Leighton, M. M., 312
Lemoyne, Jacques, map of Florida and Georgia, 82
Léon, Ponce de, expedition to Florida, 70
Lewis and Clark expedition and maps, 107
Lhuyd, Humphrey, first map of England, 51
Library of Congress, map classification and cataloging, 282, 288
Lily, George, map of Great Britain, 51
London, maps, 247, 249, 250
Long, Major Stephen, 108
Long Beach: Port Series No. 12, 218
Los Angeles: Port Series No. 13, 218
Louisiana, planimetric mapping, 123
Loxodromic charts, 17

Mackenzie, Alexander
Map of America (1801), 101
North American crossing, 69
Mackenzie River Basin, maps, 224
Mackintosh, W. A., Prairie Settlement...., 223
Maggiolo, Visconte de, world map, 71-72
Magnetic chart (U.S.), 182
Manchuria, map of railway and motor routes, 198
Manhattan Island, Iconography of (I.N.P. Stokes), 65
Manhattan Maps (Haskell), 95
Manitoba (Canada), map, 228
Map cataloging systems
American Geographical Society, 289
Military Intelligence Division, U.S. War Department library (Geographic Branch), 289-91, 295
State Department, U.S., Office of the Geographer, 291, 295
Map classification systems
American Geographical Society, 283
Grosvenor Library, 284
Library of Congress, 283
Military Intelligence Division, U.S. War Department library (Geographic Branch), 286
State Department, U.S., Office of the Geographer, 286, 295

Map classification systems (Cont.)
Virginia State Library, 285
Mapping plan, national (U.S.), 172
Marbut, Curtis F., 138
Marine charts (Canada), 226
See also Hydrographic chart publications
Marinus of Tyre, 5-6, 23
Marquette, Father, 86, 90
Maryland State Planning Commission
Report on mapping, 338
Medicean Atlas (1351), 20
Medieval mappae mundi, 3, 10, 17
Mercator, Gerhard, 4, 28, 29, 51, 80-81, 82, 93
Mercator's projection, 28
Meridian, prime, 7, 35, 38
Mesopotamia, map, 256
Mexico
Boundary maps
United States and Mexico, 158, 194-97, 198, 199
Communication map, 219
United States of Mexico, map, 198
Official mapping, 237
Miami, Fla.: Port Series No. 8, 205
Michigan
Planimetric mapping, 123
State Planning Commission
Report on maps, 338
Military Intelligence Division (U.S. War Department, General Staff), 170-71, 219, 289-91
Military maps (topographic quadrangle maps, U.S. Army), 160, 206
Miller, Konrad, 10
Milwaukee, Wisc., Port of:
Lake Series No. 3, 208
Minas Geraes (Brazil), maps, 234
Mineral surveys on public lands (U.S.), 148
Minor civil divisions (U.S.), maps, 180
Mississippi River
Early mapping, 62, 82, 90-92, 108, 110-11, 162-63
Modern mapping, 210-12
Mississippi River Commission
Organization and chart publications, 164-66, 210-12
Missouri River and tributaries
Charts, 108, 214
Mitchell, John, map of North America (1755), 97, 199
Mobile, Ala.: Port Series No. 3, 209
Moll, Herman, map of British colonies, 97, 156
Monterey, Calif.: Port Series No. 12, 218
Montevideo, maps, 239
Morocco, list of maps, see G.S. G.S. catalogue; also catalog cited on p. 50
Morse, Jedidiah
American Geography, 99, 105
Mortier, Pierre, 33
Mosaic maps, defined, xiii
Motor road maps, see Highway maps
Motorist guide maps (U.S. National Park Service), 188
Müller, Frederick
Remarkable Maps, 75
Münster, Sebastian, 51, 71
Myritius
Opusculum geographicum, 58

National forests, see Forests, national
National mapping plan (U.S.), 172
National Park Service, U.S., 169, 187-88
National parks, maps
Canada, 223
United States, 187-88
National Resources Board, U.S.
Report, 124
National Resources Committee, U.S., 332, 333, 335-37, 338
Natural land-use areas of the United States, map, 176
Nautical charts, see Charts
Navaja Indian Reservation, maps, 145
Naval air pilots (U.S.), 153
Navarrete, M. F. de, 61
Navigation charts, see Charts
Netherland, official mapping, 278-79
New England
Early maps, 79, 95, 96
Regional Planning Board, 333
New Jersey, Atlas of (topographical), 323
"New Map of Shakespeare," 82
New Netherland, early maps, 96
New Orleans, La.
Industrial Canal, charts, 210
Port Series No. 5, 210
New World and European colonial system, map, 201
New York: Port Series No. 20, 203

Nicaragua, map, 235
Nicollet, I. N.
Mississippi River maps, 110
Nicollet, Jean, 85
Nigeria, map list, see G.S.G.S. catalogue
Norden, John, 53
Nordenskiöld, A. E.
Facsimile Atlas, 15
Periplus, 17
Northern Ireland, note on mapping, 243, 253
Northwest passage, 63, 64, 67, 69, 70, 100
Northwest Territories (Canada), note on mapping, 228
Norway, official mapping, 280
Nova Scotia (Canada), maps, 229

Oakland, Calif.: Port Series No. 12, 218
Ocampo, Sebastian de
First circumnavigation of Cuba (1508), 65
Ocmulgee River....charts, 205
Oconee River, Ga., charts, 205
Odum, Howard W., 335
Ogilby, John, road surveys and maps, 54
Ohio River and tributaries
charts and chart lists, 215
Oklahoma State Planning Board
Compendium of maps, 338
Ontario (Canada), maps, 229
Ordnance Survey, see Great Britain
Oregon Country, map, 199
Oregon State Planning Board
Mapping program...., 338
Ortelius, Abraham, 3, 28, 29, 51, 83
Ouachita River charts, 212
Outline maps
England and Wales, 250
Great Britain, 246, 247, 248, 249, 250
United States (whole area)
County outline maps, 176
Outline base maps (various projections), 220
See also Base maps
Outlook charts of agriculture (U.S.), 177

Pacific coast of North America, early surveys, 61, 102-3
Pacific Northwest Regional Planning Board, 333
Pacific Railroad surveys (1853-1860), 112-13
Padron real of Spain, 73
Palestine, map, 266
Panama Canal Zone, charts, 182, 235
Pantojo, Juan
Plan of San Diego (1782), 200
Paraguay, mapping, 238
Paris, Matthew, maps, 15
Parker, Samuel, 110
Parkman, F., 92
Paullin, C. O., Atlas of Historical Geography...., 81
Peking, map, 266
Pensacola, Fla.: Port Series No. 3, 209
Peru, Carta nacional, 239
Petty, Sir William, maps of Ireland, 55
Peutinger, Conrad, 9
Philadelphia and Chester, Pa.: Port Series No. 4, 203
Philippine Islands, various maps and charts, 182, 199
Photographic mapping, defined, xiii-xiv
Photography, aerial, in United States, Status of (map), 220
Physical maps, of
England and Wales, 250
Scotland, 250
United States, 220
Picard, Jean, 38
Pike, Captain Z., 108
Pilot charts of the oceans, 153
Pineda, Alonso de, map of Mexico (1519), 60
Pitman, Captain P.
Mississippi River map (1768), 163
Planimetric maps and mapping (U.S.), xiii, 141, 143, 150, 172, 224, 335
Planning maps, see Public planning organizations
Plat records of public lands (U.S.), 148
Pont, Timothy, 54, 55
Popple, Henry, Map of British Empire in America, 97
Population map of Great Britain, 250
Port Series reports (U.S.), see under names of port cities
Portland, Me.: Port Series No. 1, 202
Portland, Ore.: Port Series No. 7, 217
Portolan charts, 17-20
Portuguese New World cartography, 60, 66-67, 76, 77, 79

Post route maps (U.S.)
Early maps, 155-57
Modern maps, 191-92
Official Postal Maps (a list by U.S. Post Office Dept.), 191
Powell, J. W., 114
Power maps, of
Africa,, North, 340
Europe, 340
France, 340
Paris, 340
United States
States (individual), 326
United States (whole area)
Electric power, 147, 183
Water power, potential, 146
Precipitation maps (U.S.), 175
Prince Edward Island, maps, 229
Progress maps of Federal-aid highway system (U.S.), 142, 179
Prussia (Germany), geologic maps, 272
Ptolemy, Claudius, 6-8, 22, 23, 25, 27, 41
Public land states, maps of (United States, Alaska, Hawaii), 149, 184
Public planning organizations (U.S.)
Local, 327-328
Regional
Interstate, 332
Intrastate (Tennessee), 330
Metropolitan, 331
Tennessee Valley, 334
State-wide, 328
Puerto Rico, maps and charts, 182, 203, 240

Quebec, county maps, 229, 230

Radio call areas, amateur.... (U.S.), map, 183
Raffeix, Father Pierre, 91
Railroad map, of
Europe, 341
United States (official), 220
Reclamation Bureau, U.S., 151, 189
Reconnaissance erosion survey maps (U.S.), 145, 326
Red River (U.S.), charts, 212
Regional planning (U.S.), see Public planning organizations
Reid, John, American Atlas, 105
Rhenish-Westfalia, map of district, 261, 270
Rhineland, maps, 263
Rhodesia, list of maps, see G.S. G.S. catalogue
Ribero group of maps, 73, 74, 75
Rio Grande boundary maps, 195, 197, 199, 200
River charts (U.S.), by
Corps of Engineers, U.S. Army, xi, 161-66, 202-19
Geological Survey, U.S., xi
See also Corps of Engineers, U.S. Army; and under names of rivers
Road maps, see Highway maps
Rodane map (Norway), 281
Roggeveen, Arend, Atlantic coast charts, 96
Roman Britain, map, 250
Roman Empire, International Map of, 251, 341
Ross, Lieutenant
Mississippi River map, 163
Rotz, Jean, 77
Roy, General William, 57
Rural delivery county maps (U.S.) 154, 191-92
Russia, Western, map of, 265
Ruysch world map, 68

Sailing charts (U.S.), 129, 182
Sailing directions (by U.S. Hydrographic Service), 153
St. John River, Fla.
Blue-line prints, 205
St. Lawrence River exploration, 76, 89
Samoa, charts, 182
San Diego, Calif.
Facsimile map (1782), 200
Port Series No. 12, 218
San Francisco, Calif.: Port Series No. 12, 218
Sanborn Company fire insurance maps (U.S.), xii
Sanders, Christian, 40
Sandusky, Huron, and Lorain, O.: Port Series No. 8, 208
Sanson, Nicolas, 32, 33, 89, 94
Santa Cruz, Alonso de, 73
Santarem, Vicomte de, 16
Sao Paulo, maps, 234
Saskatchewan (Canada), maps, 230
Satilla River, charts, 206
Sauerland (Germany), map, 263
Savannah, Ga., district maps and charts, 205-7
Savannah River charts, 206
Saxony, official maps, 267, 271
Saxton, Christopher, 52
Scarparia, Jacobus A. de, 22

Schmeckebier, L. F., 114
Schoolcraft, Henry R., 110
Science Advisory Board (U.S.)
  Report, 120
Scotland, mapping, 244, 247, 248, 249, 250, 252, 253
Scribner Atlas of the United States (1880), 180
Seattle, Wash.: Port Series No. 7, 217
Sectional airway maps (U.S.), see Aeronautical charts
Seller, John, 55, 96
Senex, John, 97
Settlement plans (Canada), 225
Shantung, map, 266
Shenandoah National Park, map, 188
Smith, Captain John, 95, 96
Smith, Jedidiah, western explorations, 109
Smithsonian Institution
  List of publications, 193
Snellius, Willebrord, first triangulation, 37
Soil Conservation Service, U.S., 143-45, 180, 326
Soil Erosion Service, U.S., see Soil Conservation Service
Soil maps, of
  Canada, Western, 223
  Europe, 341
  United States
    County soil maps, 138-40, 178, 323
    Soil Map of United States (1:2,500,000), 139
    "Soil provinces" in United States, map, 140
    Soil texture groups in United States, map, 140
Soto, Hernando de, 62
South Africa, list of maps, see G.S.G.S. catalogue
South America, topographic mapping, see Chapter XIII
Southern Regions in the United States (H. W. Odum), 335
Spanish New World cartography, 60, 61, 70, 102-3
Speed, John, 53, 54, 96
Stamp, L. Dudley, 247
Stansbury, Howard, 112
State and regional planning organizations (U.S.), bibliography of reports, 338
State highway maps (U.S.), 321-23
States, maps of (U.S.)
  Base maps, 124, 322, 326
  Coal maps, 326
  Contour maps, 326
  Electric power maps, 326
  Erosion survey maps, 326
  Geodetic control survey index maps, 325
  Geologic maps, list of, 315
  Highway maps, 321-23
  Index-circulars (showing progress of geologic and topographic mapping), 325
  Minor civil divisions, maps, 180, 325
  Oil and gas maps, 326
  Planning board maps, see Appendix IV
  Post route maps, 155-56, 191, 322
  Power maps, 326
  Progress maps of Federal-aid highway system, 142, 179
  Public land states, maps, 149, 184
  Recreational maps, 188
  State maps issued by Federal government, list of, 325
  Transportation maps, 143, 180, 322
States, The Book of the (Council of State Governments), 337
Statistical Atlas of the United States, 180
Stevenson, E. L., Maps Illustrating Early Discoveries...., 66
Stokes, Isaac N. P., Iconography of Manhattan Island, 65
Storm frequency maps of United States, 193
Sudan, Anglo-Egyptian, list of maps, see G.S.G.S. catalogue
Switzerland, list of maps, see Eisenschmidt catalog
Symbols, standardized for plans, maps and charts, list of, 330
Symonson, Philip, 53
Syria, map of, 266

"T-O" maps, 12, 14, 15
Tabula Peutingeriana, 9
"Tactical maps," (U.S.), 206-7
Tampa, Fla.: Port Series No. 9, 205
Tanner, Henry Schenk, 106
Temperature, sunshine, wind, (U.S.), maps showing, 175
Tennessee Valley Region
  Atlas of...., 334
  Cartographic summary, 338

Tennessee Valley Region (Cont.)
Indexed bibliography, 338
Planning activities, 334-35
Texas, historical diagram, 200
Theatrum orbis terrarum (Ortelius), 28, 51
Thompson, David, 101
Tidal and current charts (U.S.), 131, 181
Tientsin, map, 266
Tobago (West Indies), map, 240
Toledo, Port of: Lake Series No. 7, 208
Topographic maps and mapping
Alaska, 124, 126
Argentina, 233
Austria, 274
Bolivia, 234
Brazil, 234
Canada, 222
Central America, 219, 232
Chile, 234
Colombia, 236
Denmark, list of maps, see Eisenschmidt catalog
Ecuador, 237
France, 43, 46, 49-50
Germany, 258
Great Britain, 246
Guianas, 257
Irish Free State, 243
Mexico, 237
Netherlands, 278
Northern Ireland, 243
Norway, 280
Peru, 239
Philippine Islands, 182
Scotland (included with Great Britain)
Switzerland, list of maps, see Eisenschmidt catalog
United States, maps by
Corps of Engineers, U.S. Army, 158-61, 206
Coast and Geodetic Survey, U.S., 128, 182
Forest Survey, U.S., 141
Geological Survey, U.S., 121-24, 185
Mississippi River Commission, 165
Uruguay, 239
Venezuela, 239
West Indies, 240
Toscanelli, Paolo, 24
Township plans
Canada, 223, 225
Alberta, 226
Quebec, 230
Saskatchewan, 231
Township plats (U.S.), by General Land Office, 148, 184
See also Farm unit plats
Townsite plats (U.S.), by Bureau of Reclamation, 189
Traffic diagrams
Great Britain, 248
United States, 143
Transportation maps
London (England), 247
United States, 143, 180, 322
Trinidad (West Indies), map, 240
Tschili, map (1:200,000), 266
Turin, map, 12
Turin-Spanish planisphere, 70
Turkey-Armenia, boundary map, 197
Type-of-farming areas, United States, map of, 177

Uganda, list of maps, see G.S.G.S. catalogue
Union of South Africa, list of maps, see G.S.G.S. catalogue
"Unit" map entry card, 288, 289
United States Government
Map sources and maps
Aeronautics Bureau, 160
Agricultural Economics Bureau, 167
Agricultural Engineering Bureau, 167
Air Commerce Bureau, 167
Animal Industry Bureau, 177
Army Air Corps, 170, 201
Board of Engineers for Rivers and Harbors, 202
Census Bureau, 168, 180-81
Chemistry and Soils Bureau, 138-40, 178
Coast and Geodetic Survey, 127-34, 181-82, 220, 325
Corps of Engineers, U.S. Army, see the individual heading for this entry
Federal Board of Surveys and Maps, xiv, 171, 220
Federal Communications Commission, 183
Federal Power Commission, 145-47, 183
Foreign and Domestic Commerce Bureau, 168
Forest Service, 140, 178
General Land Office, 148-50, 184
Geological Survey, 121-27, 185-86, 220, 240, 325-26
Great Lakes Survey, 134-36 208

United States Government
Map sources and maps (Cont.)
Hydrographic Office, 151-55, 190
Indian Affairs Bureau, 150, 187
International Boundary Commissions (Dept. of State)
United States, Alaska, and Canada, 136-37, 193
United States and Mexico, 157-58, 194-97
Military Intelligence Division, General Staff, 170-71, 219, 235
Mississippi River Commission 164-66, 210-11
National Park Service, 169, 187-88
Post Office Department, 154-57, 191-92
Public Roads Bureau, 142-43, 179-80
Reclamation Bureau, 151, 189
Soil Conservation Service, 143-45, 180, 326
State, Department of, 197-201
United States Government Manual, 144
Upper Mississippi River and tributaries, charts, 212-13
See also Mississippi River
Uruguay, maps, 239
Utah State Planning Board
Index of maps, 338

Vancouver, Captain George, 100
Vancouver, Wash.: Port Series No. 11, 217
Vaugondy atlases, 94, 95
Vegetation (U.S.), maps of, 175
Vérendrye, Sieur de la, 87, 94
Verrazano, Giovanni da, 70
Verrazano, Hieronimus, 71, 72
Vignaud, Henry, 25
Virgin Islands, charts and maps, 182, 240
Virginia, map (John Smith), 95
Vizcaino, Sebastian, 61

Waghenaer, Jucas J., Spiegel der Zeevaart, 30
Waldseemüller, Martin, map, 67
Warren, Lieutenant G. K.
Map of Western United States, 113
Washington, D.C.: Port Series No. 16, 204
Water power, potential, in United States, map, 146
Watermarks, use of, in dating old printed maps, 293
Watson, Lieutenant-General, 242
Weather maps (U.S. Weather Bureau), 180
Weimar-Spanish maps, 73, 75
West Indies, official mapping, 240
Western United States, early map of, 113
Wheeler, G. M., 114
Wieder, F. C.
Monumenta cartographica, 95
Williams system of map classification, 285, 289-91, 295
Wilmington, Del.: Port Series No. 4, 203
Wilmington, N.C.: Port Series No. 9, 204
Wilton, William
Mississippi River map, 163
Wit, Frederick de, 31
Wolfenbüttel-Spanish map, 74
Wood, William, New England Prospect, 96
World Atlas of Commercial Geology, 186
World charts and maps
Aeronautical chart, 339
Bathymetric chart of the oceans, 339
Geologic map, 339
International Map of the World (1:1,000,000), 340
See also separate entry for this map; consult also U.S. Hydrographic Office catalog
Württemberg (Germany), official maps, 267, 268, 271, 273
Wytfliet, Cornelius, earliest atlas of America, by, 83

Yazoo River charts, 212
Yukon Territory, mapping, 231

Zaltieri map, 69
Zatto, Antonio, maps of North American colonies, 98

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